THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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SOCIALISM.

WHEN Lord Rosebery entered upon the preparation of his fascinating work, "Napoleon: The Last Phase," he did so with the avowed object of laying a literary ghost. All of us are haunted by mental phantoms which we would fain set at rest; in the minds of many at this present juncture the spectre of Socialism occupies a prominent place.

Whither will it lead us? What effect will it have upon trade and industry? Is it "catching on" with the Labour Party and the Trade Unions? What can we do to prevent its further advance? These are questions which every man who has time to think, and anything to lose, is constantly repeating to himself.

Some admirable words which fell from Mr. Inglis in the course of his presidential address to the Institution of Civil Engineers fully justify a reference to Socialism. He pointed out that "labour is the beginning and end of engineering, and any interference with the application of labour to engineering undertakings at once affects the profession, and periods of stagnation are liable to result therefrom." "Nature's laws," he went on, "are definite in the physical world, and, so far as they are known, there is every reason to believe that they are equally exact in the economic or political world. But the treatment which many of our labour problems are now receiving at the hands of so-called 'leaders' cannot be reconciled with any nature treatment. . . . . Legislation which protects labour interests to the point of partiality, and which does not at the same time pay due regard to the interests of those who have to initiate enterprise and dispose of the products of labour, is proceeding in an illogical and impossible course, which can have but one ending."

Let us single out from among the avowed objects of Socialism, as advocated by its more extreme adherents, a few of those which must immediately affect the electrical world. Take the official Programme of the Social Democratic Federation. In the so-called "Utopia" which would be established were this body to have its way, there would be no indirect taxation. Instead, there would be a cumulative tax on all incomes and inheritances exceeding £300. Labour would be organised under public ownership and control on co-operative principles. Railways and electric light undertakings would be handed over to public ownership. No man would be allowed to work at any industry for more than eight hours a day, or 48 hours per week. There would be a minimum wage of 30s. a week for all workers; there would be public provision of useful work at not less than Trade Union rates of wages for the unemployed. There would be free State insurance against sickness and accident, and free and adequate State pensions or provision for aged and disabled workers. Upon public bodies would devolve the duty of providing healthy dwellings for the people.

A glance at the ideals which other Socialist organisations have set before them reveals "the same dog with a different piece of string." They are all based upon the assumption that the poor can be made richer by making the rich poorer; that individual effort shall be stamped out; that there shall be generally a levelling-down instead of a universal levelling-up.

It may be said, of course, that a programme so wild and extravagant can never become part of any scheme of practical politics; that the common sense of the nation would revolt against it, and so on. But look at it again! Some of the dreams of the Socialist have become realities.

The municipalities have to a large extent assumed control of the means of transit. The eight-hours day has become a reality in certain industries. Something very like a minimum wage has been established by the efforts of Trade Unions. The principle of supplying work for the unemployed has been recognised.

How, then, are the forces of the Socialist to be satisfactorily met? To be opposed to the doctrines which he inculcates is one thing, but to have the power of persuading the working man that he is grasping at a shadow when he allies himself with Socialism is another! The arguments advanced by the Socialist are captivating to the uninstructed.

The theory of at least one prominent Socialist writer is that within the capitalist system, and in the measure that the wealth of capitalists increases, the labouring classes must become continually poorer, more dependent, more ignorant, more degraded in intellect and character. But what are the facts? Within this very system, knowledge, and the desire for knowledge, have reached the lowest strata of society; crime has decreased, wages have risen, and material comfort has become much more common. The doctrine that the accumulation of capital necessarily tends to the disadvantage, slavery and misery of the operative classes, is clearly inconsistent with history, and is decidedly contradicted by present-day experience.

The indebtedness of labour to capital is enormous; its indebtedness to science and invention is also enormous, and it is wrong for labour to ignore this as it is for capital, science and invention to ignore their enormous indebtedness to labour.

In the electrical world, as in every other department of industry, there must be leaders of men. The leaders must have pluck and ability, and a sufficient command of capital to enable them to prosecute great enterprises. The outlay of capital may be unproductive for a considerable time; yet outlay of capital nearly always means employment of numerous workmen.

Of enterprises which are started a vast number are unsuccessful, yet the workmen connected with them get the ordinary wages current in the trade at the time. Many industrial companies pay in the course of a year neither interest nor dividend; but they all pay wages. These facts are often overlooked by the proletariat. The orator at the street corner has imbued him with the notion that the capitalist is battening on the labour of his workmen.

Socialists aim at freeing labour from what they regard as the tyranny of capital. "Plunder the rich" is the eternal cry. It may well be that some of the rich who make a bad use of their wealth are not entitled to much consideration; but, as Prof. Flint has written, "By all means let us condemn the 'wicked rich,' but let us be sure that it is the '*wicked* rich,' and only the 'wicked rich,' that we condemn."

But the workman who would plunder the capitalist is but feathering a shaft which would penetrate deep into his own heart.

The Socialist spends much of his energy in discrediting capital. He charges it with doing nothing for production, and represents it as being idle, inefficacious. He says that, consequently, labour deserves to have all, and that capital is not entitled to receive anything.

A little thought would seem to be sufficient to dispel these illusions. Take a simple illustration. Capital is spent on machinery. By the aid of machinery the people of Great Britain can do more work than all the inhabitants of the earth can do through the mere exertion of their unaided muscles. Who will deny that some of the credit of bringing about these happy results is due to capital?

The bulk of British wealth has had its source within the capitalist system itself, and is not—directly, at least—inherited plunder.

It is impossible to shut our eyes to the fact that the present tendency of the Trade Unions is to be led astray by the Socialist. And what will be the inevitable result?

The Socialist is unable or unwilling to learn the lesson inculcated by what has happened during the last few years as a result of the growing power and influence of the Trade Unions.

The masters have been taught to combine. Unable to resist the forces marshalled against them by the Unions, individual employers have sought the protection of their fellows by agreeing together on a course of action. A war upon capital only has the effect of making capital stronger and more united than before. The cry of the more extreme among the Socialists is for Communism and universal brotherhood! But these things cannot come about, save by revolution. In the meantime, so long as law and order prevail, the capitalist, and the groups of capitalists, are masters of the situation. Capital is not fixed and immovable. It can take unto itself wings and fly away. If the Trade Union, urged on by the Socialist, becomes more and more autocratic in its demands, the employer can seek unfettered labour in other lands, and no power as yet known to English law can stop him.

Institution Proceedings.

As we mentioned last week, Messrs. Handcock and Dykes's paper was read in abstract only at the London meeting of the I.E.E. We note with interest in the official announcement of the meeting to be held at Manchester on Tuesday next, to discuss a paper on German electrical methods, that the authors "will read an abstract only of their paper," and we congratulate the local Committee on this forward step, which, we are certain, will be welcomed by the great majority of the members. The next reform, we hope, will be the dispatch of advance proofs to all the members of the Local Section, not only, as offered, to those who apply for them. The postage would not cost a penny more, for the announcement of the meeting could be sent out with the paper for a halfpenny; but even if additional outlay were necessary, we feel sure that it would bear good fruit.

"What Nonsense!"

Our friends of the *Gas World* fall foul of the Catford "Electra House," which they describe as a monstrosity, that has "no place in the practical workaday world." They go on to say: "We are told that the estate is being covered with houses that will let at rents ranging from £32 to £55 a year, and we are expected to draw the inference that each of these houses will become a duplicate of 'Electric House.' *What nonsense this is!*"

We venture to italicise the comment, which so admirably characterises the remark which it follows. It was never for one moment suggested by anyone—except the *Gas World*—that any person would think of fitting up his house like "Electra House," which, as our contemporary innocently adds, is purely "a show place, where all cooking, heating, and lighting is done by electricity, regardless of cost."

An amusing feature of the matter is that the gas company's own "Gas House" is situated a couple of doors away. We have not suggested, however, that anyone would dream of living in such a place—that would

indeed be a nightmare. It is an interesting, though pathetic, sight to see the various gas-burners in the South Metropolitan Gas Company's big show-window in a main road not far away being laboriously lighted, one by one, when dusk approaches. Where are those vaunted switches with which, we have heard, gas-burners can be lighted from a distance, just like electric lamps? We knew of one house where they were installed, but there the lamps are now lighted in the old-fashioned way. The imitation was hardly flattering—for it proved a failure.

Copper.

The combination of producing, refining and selling companies, which has occupied the financial papers so much recently, appears now to be in a fair way towards accomplishment. According to the *Financial News*, the Cole Ryan Syndicate will supervise mining operations and delivery of the ore to the smelters; the smelting and refining of the ores will be done by the Guggenheims; and the disposal of the metal will be in charge of the Lewisohn interests, through the medium of the United Metals Selling Co. Messrs. Rothschilds, as representatives of the Rio Tinto, will be approached with an agreement. The Lake mines, however, will not join the confederation.

The proportion of purely American names in the above arrangement affords an assurance that the financial section of the business will be ably managed, and that the enterprise holds out prospects of commercial success. The result, according to the *Financier* (November 29th), is an increasing bull account in New York. The slight downward tendency of prices here does not coincide with this view of the case, unless the "nerves" which must ultimately affect the market have already set in.

Those who anticipate a revival of trade in England in the early part of next year, will, on general indications, be on the look-out for renewing stock at the present prices. As, however, the commercial world does not generally hold large stocks, but quotes on the price of metal at the time of order, it will probably prefer to continue watching the price in anticipation of the dips which will probably occur when the speculators for the rise take their profits. The *Financier* article says, with justice, respecting the aspect of affairs from this end, "The enormous stocks of copper, visible and invisible, will inevitably exercise a steadying effect on any upward movement."

These stocks, as shown by Messrs. Merton's circular, have assumed formidable proportions. Visible supplies for the end of November stand at 105,743 tons, and supplies generally are well ahead of deliveries; 50 tons have been reshipped to the States.

The increase in visible supplies is principally in stocks at English ports. The exports from the States for November are estimated (*Daily Telegraph*, November 24th) at 25,000 tons, against 23,660 for October. Comparing this with the visible supply figures, it will be seen that the market has still a considerable holding on the side of placidity.

Lead.

With a steadiness worthy of its physical characteristics, lead has for some time maintained its price curve in a close approximation to the straight line. It appears to be honestly affected by brisk trade only, and out of reach of speculative troubles. Some interesting figures respecting this metal are given in an article published by the *Financial Times* in their issue of November 26th. We find that October's imports amounted to 15,236 tons, as against 15,236 tons in September, and 16,553 tons in August. The total for the ten months ending October, 1909, is 170,730 tons, as against 198,617 tons for 1908, and 167,075 tons for 1907. A trade combination, the International Lead Convention, certainly exists, but it controls little more than 25 per cent. of the world's total output.

The article referred to mentions that hopes of trade revival and consequent increase in price are entertained by producers.

Licensed Abuse.

We were recently present in Court when a well-known engineer was giving evidence. He was the manager of a large works, and had gone to that position by request of the firm, having given up his private practice to do so. This fact was fastened upon by counsel as a basis for the insinuation that the gentleman in question had failed as a consultant and was, let us presume, therefore not worthy of credence. Now, in the first place, a man of exceptional ability may fail completely as a consultant simply from lack of work, for, contrary to popular belief, work does not pour in upon a man when he hangs out his shingle. And again, a good position with a manufacturing firm may be a quite sufficient excuse for dropping even a fairly remunerative consulting practice.

But be these things as they may, how long are engineers to submit to the coarse rudeness of legal men in respect of ordinary business moves and transactions, which are travestied and twisted to imply that something disgraceful or scandalous has been the moving cause? The same counsel was full of flouts and gibes and jeers in respect of a special appliance devised by another engineer, though the device had accomplished its intended purpose. By his long-winded prolixity, and the emphasising of points freely conceded by the other side, he must have involved in extra expenses alone more than the amount at issue between the contending parties. And only thus, apparently, can trade and commercial disputes be settled. Anything more ridiculous to the technical man than many of the questions of certain counsel it is impossible to conceive. Absolute non-acquaintance with the subject in hand, childish inability to comprehend the simplest explanation, and the wasting of time on unessentials that these produce, are all in the day's doings. But the worst feature is that the gentlemen of the wig and gown appear to regard it all as rather a good joke; that all in Court who may speak otherwise than when asked a question, are just those who know nothing of the matter in hand. And it is no unusual spectacle for these gentlemen to wrangle over three different parts of machinery, thinking all the time they are talking of the same part. It would be funny were not industry paying for it all. At this day, unless the sum in dispute is very large, neither side can hope to get back anything by going to law about it. The winner loses, and the loser loses doubly. The points which counsel emphasise are almost invariably of no real consequence; points which to an engineer are everything are passed by. If the bench were occupied by an engineer, and he were to examine the witnesses on both sides after they had each told their tale, he would in the course of half a day or a day deliver a judgment that would require many days of the ordinary legal procedure to arrive at, and the engineer's judgment would be better and fairer. It cannot be contended that the present system of taking expert evidence is sound. Experts are exposed to all manner of silly questions with the view of catching them tripping. The questions cannot be answered by yes or no, yet unless such a false answer is given the witness is insulted by counsel, who demands answers pat to the most ridiculous questions.

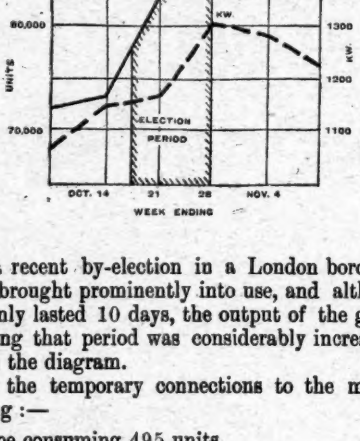
It is really time that this subject was taken into consideration by Chambers of Commerce with a view to the amendment of the whole procedure. It is indefensible that a judicial procedure that has grown out of criminal law procedure should be employed in industrial disputes. Prior to the industrial system of modern times we may suppose that Courts of Law dealt with little else than the vulgar crimes of robbery, murder and treason. But such Courts and their traditional Old Bailey bullying are not suited to modern conditions, and the abuse has grown to such a pitch that it has become a crying injustice.

TEMPORARY ELECTRIC SUPPLIES FOR ELECTIONEERING PURPOSES.

By L. B. HOGARTH A.M.I.E.E.

As the fate of the Budget has been sealed, we shall shortly be in the midst of a General Election. The attention of central station engineers may be drawn to the important part that electricity can take in the election campaign.

The ease with which metallic-filament lamps, flame arcs, electric lanterns, &c., can be applied should afford valuable means for improving the output of some of our smaller electric supply undertakings, especially in districts where there are vacant shops having the electric supply already installed.



During a recent by-election in a London borough, electricity was brought prominently into use, and although the campaign only lasted 10 days, the output of the generating station during that period was considerably increased, as is shown from the diagram.

Amongst the temporary connections to the mains were the following :—

Bioscope consuming 495 units,
Electric sign consuming 167 units,
Bioscope consuming 237 units,
Two poster display shops consuming 64 units, &c.

The services laid for the bioscopes were paid for by the consumers, whilst the sign and the poster shops were services already laid. All were charged at a flat rate of 3¾d. per unit. The safety and cleanliness of electricity render it specially suitable as a cheap and efficient illuminant for electioneering purposes.

TROUBLE WITH A SLIPPING BELT.

By DOUGLAS S. MARTIN.

PRETTYBOY knocked the ash out of his pipe. "Yes," he said, "there is a lot of humour in testing which the outside world wots not of. The suburban clerk on the Tooting tram hears the buzz of the motors, but he knows nothing of the funny things which Parker said when he was running those motors round in the shop, and burnt out his ammeter." He gazed meditatively at the ceiling.

"And though one might not think it," I observed, "there is a humorous side to a spanner really . . . . if you get it across the armature terminals in the right way . . . ."

Wilkins took his feet off the mantelpiece, and leaned forward in his chair.

"Do you remember old Nobby Wimpole's 100 KW.?" he asked, with a chuckle.

None of us did, so Wilkins gave us the yarn, which I set down here, very nearly in his own words.

One morning, about four years ago, the boss called Nobby Wimpole into his office. One glance at the boss's face told Nobby that an affair of importance was in the wind.

"Wimpole," the boss began, "there is something I want you to do. An official from the Admiralty is coming here to-day to see that 125-horse motor on load. I can't spare you the power house turbine. You have got to get 100-KW. out of the E.T.M.* !"

Nobby bowed his head. "I will try, Sir," he said.

"You will experience some difficulty. Your motor will be overloaded, and your belt will slip—but you must get your load. 100 KW. will about do it. You must get them!"

"I will get them, Sir," said Nobby simply. He lifted his head and squared his shoulders as if adjusting a burden to his back.

"It will be a difficult job, but you may rely upon me."

Cowcraft didn't care much for melodrama in his office, so he added rather curtly, "And lose no time, Wimpole."

"I go," said Nobby. And he went.

So Nobby collared a great tin of sticky maggie, shut down the E.T.M. set, put on his slops, and set to work. I reckon he about emptied that tin. He smothered it over the pulleys, and ladled it on to the belt. Then he picked his men, got the Admiralty motor out, wired it up, put in his meters, and started on his load.

A few of the curious ones had gathered round to see how high he would get. Nobby reached three-quarters without a sign of trouble, glanced round at the set to see how the belt was standing it, waved Bramble up on the tubs, and touched the hundred. Just kept it on for a few seconds to see if he was really there, and then pulled it down again.

A little buzz of cheering came from the assembled testers. Nobby had got 100 KW. out of the E.T.M.! Good old Nobby! And Nobby, who always reckoned he could do anything a bit better than anyone else, smiled his appreciation. The news was all over the place in five minutes. Engineers, hurrying through the works, wondered what the row was about. Navvies, pushing spiders along the shop, paused for a moment to glance at the youth who had succeeded in cajoling no fewer than one hundred large-sized kilowatts from their fastnesses inside the E.T.M. Nobby meanwhile stood there with the "alone-I-did it" look on his face.

Then he sent one chap up to Pullman, the engineer, to tell him that the Admiralty motor was on load, and he could bring the official down when he liked; and then he sent another chap to tell the boss; and the boss came up and told Nobby that he had done a smart thing; and Nobby said not at all, and all that sort of thing; and Bramble—aha, Bramble!

Bramble meantime was watching all this, and saw that the chance of his life-time had come. He had a grudge against Nobby Wimpole. A month before, on night-shift, Bramble had gone into work one evening in excellent spirits. Found he couldn't get any juice. Hunted for open circuits high and low. After two hours' hard swearing found someone had shoved a black wooden brush in his exciter, with the pig-tail stuck on and everything. Next day found out it was Wimpole. Bramble didn't love Wimpole much after that.

So while the chap was telling Pullman and the official to come down, Bramble went along to the traction board, and collared a bucket of railway grease. Soft, juicy grease. With a deft hand he applied it to the belt of Nobby's set. Smothered it over the pulleys, and ladled it on to the belt. Left it with about as much grip as Balaam on a donkey.

Pullman arrived with the official, and introduced him to the boss. The official said what a nice shop it was, and the boss said what a rotten summer we'd been having, and then they looked at the induction motor. They told Nobby to run it round. Nobby ran it round.

The official, flicking the dust from his coat, as if the whole thing bored him inexpressibly, asked if they would give him some load. He suggested 125 horse. Nobby looked delighted, and offered him a couple of hundred. No? Very good.

Nobby moved round behind the table, glanced at his cycles, placed one hand on his ammeter switch, and plugged load on. Brought up the field of his load generator a bit, and then suddenly, when he was taking only about 30 KW.

* A D.C. motor fed from the works supply, and driving a 70-KW. alternator, which supplies current for testing induction motors.

from his machine, heard his belt squeaking. Couldn't understand it. Waved Bramble up on the tubs. Got about half load when the bally belt started flapping like a flamingo. Pullman & Co. all looked round, wondering what was up, and Nobby started getting feverish. He ran his fingers through his hair—couldn't make out what had happened. Saw that, anyway temporarily, he was done, so pulled off his load, and called out to Bramble to see if the E.T.M. belt was O.K. Bramble had a look, and informed Nobby that the belt was quite as firm as a couple of rocks, also observing that he (Nobby) had in the first case probably read his meters wrong, and fancied he had got his load when he hadn't. Nobby, looking hot, flushed and very sick, told Bramble to go to the devil. Cowcraft bit his lip, and the official looked shocked.

Wimpole, with blank despair in his heart and in his face, called out, "Are you right?" and banged on his load again. Bramble, with a horrible smile in his sleeve, jerked up the load. Nobby heard the dreadful flapping, and saw his ammeter needle floundering about between nothing and a quarter load. Through misty eyes saw the official fuming with impatience, and Cowcraft snorting with disgust. Fairly lost his head. Waved Bramble up blindly. Bramble, more than equal to the occasion, jammed the blessed plate right in. Deafening row from the belt, flapping and squeaking like mad . . . . and then suddenly a fearful crash . . . .

On the motor end the belt had worked its way right over the bearing; on the far end it slithered gradually to the outside edge, and came right away with the force of a thunderbolt . . . . fetched down a great shelf containing meters, portable testing sets, pliers, spanners, oil-cans . . . . Dirt, grease and bits of iron flying all over the place—the official with a couple of pints of best lubricant in his eye. . . . Nobby Wimpole, blubbering and babbling like a lunatic Chinaman, made a wild rush for the breaker; tripped up over a stool, sprawled full length, caught his foot in a rheostat lead, and fetched off his blessed motor field . . . .

Gentlemen, it has been my misfortune to assist in more than one general mess-up, but I've never heard the shop breaker come out with a lovelier crack than on that glorious day. And in the moment of Nobby's greatest mortification, Bramble came and knelt beside him, and with an arm around his neck, whispered lovingly:

"What's the price of wooden Morganite brushes now?"

WAGES ANALYSIS—CABLE-LAYING GANG.

By "INTERESTED."

The proper wages analysis of casual labour is an important item in connection with any undertaking, and one worthy of serious attention on the part of those in charge of this particular work. The total cost alone of any job is not sufficient information for an up-to-date company or works. Details are required of each part or section of the work, such as trenching, laying pipes or ducts, cable, &c., in order to enable more accurate estimates to be obtained in future cases. The more details available (within reason) when estimating the better chance one has to arrive at a close figure.

Following is a description of a method for allocating the time worked on each job to the proper headings, and one retained in use after a practical trial, which may prove useful to some readers. The case in mind deals with a "mains gang" employed in the streets, opening ground and laying therein pipes, conduit, cables, &c., for the purpose of distributing electricity, but the same idea could be applied in connection with other work where casual labourers are employed. Each job, or section of a job, is given a number so as to save a deal of unnecessary writing. Only two books are in use—or rather one book and a set of cards. They are the foreman's time book and the wages analysis cards. In order to make clear the written explanation below, the heading of a page of the book and one of the cards is given herewith:—

Daily Return of Workmen and Time for.....day.....

Name.	On.	Off.	On.	Off.	On.	Off.	On.	Off.	On.	Off.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	J. O. No.	Total hours.	Remarks.

Mains Wages Analysis. Week ending.....19 .

J. O. No.	M.	T.	W.	T.	F.	S.	S.	Total hours.	Rate.	£ s. d.	J. O. totals. £ s. d.

Foreman's Time Book.—In this book the foreman enters the time every man commences and leaves off work, and throws out the number of hours worked by each man in one of the columns bearing at the top the number representing the particular work upon which the man has been engaged. Two of these books are in use at one time, yesterday's records being left in the office to-day in exchange for those which were inside yesterday. This arrangement allows the office staff time to extract therefrom particulars for the wages book and analysis cards. Should, however, the daily changing of the books prove to be impracticable, an arrangement could be come to whereby they were changed only once a week instead of daily. The drawback to the weekly change is that it means a busy day for the office staff at the week-end making up the wages of the men. The foreman obtains the job order numbers for proposed jobs from the office, or from the engineer in charge of the department, as the case may be, the procedure not calling for description here.

Wages Analysis Cards.—These cards are made up from the information given in the time books; the total number of hours spent on each section is worked out at the various rates and the amounts are extended to the proper columns, and the whole total balanced with the wages book weekly. The illustration given above will explain matters more fully than words. These section totals are in their turn transferred to the cost cards, whereon all the time and material used is collected together, so as to give the finished cost of the work—but that is another subject.

EXTENSIONS.

[COMMUNICATED.]

Events move apace, and now the financial stability of some few municipal electricity works seems to be seriously threatened; the somewhat peculiar position in which they are placed, owing to the necessity for replacements of plant, demands very careful attention on the part of the management. In a number of works a stage has been reached when some of the original installation must necessarily be scrapped or sold, in order to make room for more modern plant in larger units than the original ones. Where floor space is limited, the small plant installed at the commencement must "go" in order to allow for extensions, which can only be carried out by putting in plant considerably more powerful on the space originally occupied by the small units. The trouble is how to provide the cash to pay for the new goods. The annual repayments have proved to be insufficient, and, for various reasons, the rate of depreciation has been far greater than estimated.

In several instances, the loans obtained for the purchase of the installation in the first case were arranged to be paid off in annual instalments covering a period of 42 years. Now, although the plant has become of little practical value as an economical means of generating electricity, only about one-third of the loan has been redeemed to date, and the question arises as to which is the better way of obtaining money to pay for the new extensions. Should the whole of the remaining portion of the original loans be repaid and fresh capital taken up, or would it be preferable

to pay for the new alterations and additions combined out of revenue account, and go on slowly paying off the old capital? The lending authority will not grant a new loan unless the remaining portions of the old one are redeemed. The position is peculiar, because there is not much in the way of precedent which can be used for guidance. Careful consideration of the possibilities in the future is required before a definite decision can be arrived at, and an intimate knowledge of the useful life of the machinery, &c., in use and that proposed to be put down is wanted. For this reason I think the question is one for the engineer or manager of the department to tackle, and not the borough accountant.

Whichever course is pursued, a heavy sum will have to be taken from the accumulated profits or reserve and depreciation accounts. Is the money in hand, or has most of the surplus in previous years gone to "relief of the rates?" Here is an instance which at once shows whether the undertaking has been deprived of money—now so vitally necessary—or whether the wiser policy has been adopted of putting by sufficient to provide for such contingencies as this.

In the event of the former course being followed, a smaller sum is required to pay off the remaining, say, two-thirds of the loans yet outstanding than if the latter course is taken, because the new plant about to be installed will necessarily possess a greater output, space for space, than the plant being ousted, and, of course, higher value. This appears to leave a balance in favour of the former method, but one must not lose sight of the fact that if another loan is taken up for the proposed extensions or replacements, the customary length of time allowed to-day for repayment is not nearly so long as was the case 10 to 15 years back, and, money being much dearer now than then, the interest charges will correspondingly be increased, and will prove in the end to be heavier than the remaining interest charges on the original loans, should they be retained. Looking only to the present, the first method is preferable, but the latter course seems to work out cheaper in the long run.

I am not going to offer a word in favour of either way, but intend to leave the matter for those more interested to argue over, as circumstances alter cases, and few stations are similar in this particular respect. The question is a ticklish one to answer, and one in connection with which councillors will do well to look after the future, and not allow the future to look after itself.

If this stage of things is reached after only 10 to 15 years' working, then in another 10 years the probability is that a much larger portion of the plant will want ousting in order to make space for other more modern and larger plant, because surely old plant standing idle whilst the cost is slowly being repaid cannot be profitable, no matter how the figures are twisted about. The conclusion drawn from the present state of the enterprise is that *all* profits must be retained until a good, sound, sensible reserve or depreciation fund is formed, and not even a sum representing 1 per cent. of the capital outlay (as arranged in the gas clauses of the Salford Corporation Bill by the House of Lords' Committee) should be taken from the department until more than sufficient is in hand to meet all possible emergencies.

THE RATIONALE OF PICTORIAL ADVERTISEMENT.

By T. W. COLE.

Supply companies, electrical contractors and such like have recently been favoured with certain lamp-advertisement cards, sent to them for show purposes. The cards in question have been apparently designed with a view to catching the popular fancy. One may, in fact, imagine the gradual development of the idea in the lamp manufacturers' minds, from the time when it was first determined to appeal to the public, to the time when the good Mr. Hassall received approval of his designs. The line of reasoning that led to this series of pictorial displays was evidently something like this: Here is a general public, who know nothing about the technicalities of lamps. We want to interest them, to catch their eye, even in spite of themselves—we want, in fact, something "popular," ergo, we want something funny. Who can draw funny pictures? Who but Mr. Hassall? And forthwith Mr. Hassall receives a commission for designs, which presently mature into the cards now familiar to the trade.

Now, in speaking thus, we must not be thought to be disparaging Mr. Hassall's abilities for poster work. Quite the contrary. We do, however, criticise the faulty survey of the situation on the part of the lamp manufacturers which led them to contemplate using pictures of this type. There is, we think, at the root of it, a fundamental misconception. The lamp manufacturers have not realised the true end of advertisement. That end is not attained merely when attention is attracted. The indispensable part is still to come—the creating of an impression which shall link favourable associations with the article advertised. For instance, take a soap advertisement poster. Here we have, perhaps, a young lady of undeniable personal attractions, caught possibly at some advantageous moment of an unfinished toilet. The artist has seized the opportunity to emphasise the soft roundness of perfect health, the sense of skin, velvet to the touch. The eye is arrested by the picture, and takes in the name of the soap at the same time. The name henceforward takes to itself in the memory certain subtle associations with clean, wholesome healthiness, shell-pink complexion and such like. Suppose, on the contrary, the picture had been of the sallow-complexioned, anæmic, pointed-elbow variety of damsel, where is the good lady that would have risked using the soap? Coming to the case in hand, we have an advertisement card showing a family at dinner under the illuminating rays of the lamp advertised. The family are (to invert a phrase) honest but "poor"—poor in looks, poor in manners, the good wife holds her knife in her left hand, the little girl "points" (which well-behaved children are taught never to do), and the pater-familias sits in his shirt-sleeves. It is all very homely and comfortable, but——and here we come to the crux of the question. Electric light is undeniably something of a social hall-mark. It is a thing that began in the houses of the "carriage and pair" people. Thence it descended to the less-favoured but proportionately ambitious neighbours. Thence to suburbia with its characteristic genteel emulations. A good lady of the latter class, on her walks abroad, catches sight, perhaps, of the lamp-advertisement in question. The poor lamp becomes immediately associated with all that is repugnant. Her whole ambition in life is towards gentility, the very antithesis of the scene which this lamp so fondly illuminates. But anyhow, even outside this one point of view, seeing that the strong plea for the electric light is on the side of its æsthetic capabilities, on the grounds of its help towards refinement of decoration, would it not have been more to the point to have so designed the advertisement, as to have insensibly conveyed an impression in which such qualities were associated?

Or to pass to another of these advertisements, what could be more foreign to such impressions than the one wherein a good man of most inelegant figure is carrying on a cryptic conversation with his ill-mannered ill-proportioned gardener, who does not even trouble to affix a "sir" to his answer. One can hardly think that the lamps so advertised will benefit from the physical and intellectual vulgarity thus so ingenuously associated with them.

One might suggest that a book on psychology might be a useful adjunct to the publicity department of the lamp manufacturers in question, and that a marker be kept in the chapter about the transference of impressions, and the laws which govern association. A due regard to such principles would, we think, prevent the advertisements being drafted, which are by their nature so obviously self-defeating.

Nitrogen from the Air.—The construction of the first Swedish nitrogen works is about to be commenced, and should be completed by the spring.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

There is little of a sensational kind in the list of applications that have been filed at Westminster for the consideration of the Board of Trade and Parliamentary Committees in the next Session. They are indicated briefly as usual in the following :—

(a) Electric Light and Power.

Bath.—The Corporation is applying for the extension of its area of electric supply, within the rural district of Bath.

Bishop's Stortford, Harlow and Epping Gas and Electricity.—Amalgamation of gas companies; powers to supply electricity; agreements with local authorities as to supply.

Brixham.—Application by R. A. Lister & Co., Ltd., for an order to supply electricity in the urban districts of Brixham and the rural district of Totnes.

Brumby and Frodingham.—U.D.C. applying for prov. order to supply electricity.

Chesham.—Application by Chesham Electric Light and Power Co., Ltd., for extension of area of supply to include borough and part of rural district of Hemel Hempstead.

Chipping Norton Gas and Electricity.—New Company; Purchase of undertakings of Mid-Oxfordshire Gas Light and Coke Co., Ltd., and the Chipping Norton and District Electric Light and Power Co., Ltd.

Church.—U.D.C. is applying for prov. order for supply of electricity.

Cleveland.—U.D.C. is applying for electric supply in its district, and part of the parish of Walton-in-Gordano.

Dawlish.—Power to U.D.C. to transfer its 1903 E.L. Order to the Dawlish E.L. and Power Co., Ltd. Extension of time for works.

Derby.—The Corporation is applying for extension of its area, so as to supply electricity in the urban district of Alvaston and Boulton, and in a number of parishes.

Farnham.—The Farnham Gas Co., Ltd., is applying for the dissolution of the company, the incorporation of a new company to take over undertaking and to supply gas and electricity. Bulk supply of both gas and electricity; repeal of 1905 E.L. order.

Frimley.—Application by the U.D.C. for a prov. order.

Gorseinon.—Application by Gorseinon Electric Light Co., Ltd., for power to supply electricity within the parishes of Gowerton, Llandilo-Talybont, Loughor (Borough) and Penderry.

Hastings.—Corporation. Compulsory purchase of site of existing electric generating station. Power to sell, let, or hire electric fittings, &c., and other powers incidental to the electricity undertaking.

Havant Gas and Electricity.—Dissolution of Havant Gas Co., Ltd.; transfer to new company; lands for electric generating station; free wiring; supply in bulk.

London Electric Supply.—Application by L.C.C. to be constituted the purchasing authority for the undertakings of certain electrical companies.

Middlesbrough.—Further powers to Corporation regarding electricity supply, including powers to supply and hire meters, cookers and fittings.

Middleton.—Corporation. Further provisions concerning gas and electricity undertakings; free wiring; supply in bulk; supply to premises outside borough.

Ormskirk.—Corporation asks for alteration of 1900 provisional order; extension of time for laying mains in compulsory area; transfer to Ormskirk Electric Supply Co., Ltd.

Radcliffe.—Application for a provisional order by the Lancashire Electric Power Co.

Reading Electric Supply Co., Ltd., is seeking powers for extension of area of supply; supply in bulk within and beyond area; wiring consumers' premises, &c.

Runcorn.—Application for a provisional order for supply of electricity in Urban and Rural Districts of Runcorn is being made by G. H. Cox and H. J. Falk, of Colonial House, Water Street, Liverpool.

Runcorn and Weston.—Application for a provisional order by the Castner-Kellner Alkali Co., Ltd., Weston Point, Runcorn.

Sheffield.—Corporation is applying for power to supply electricity in parish of Tinsley.

Smethwick.—The Birmingham and Midland Tramways Co., Ltd., applies for power to repeal or amend the 1898 E.L. Order; to transfer the 1898 order to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Warrington.—Further powers to Corporation relating to gas and electricity undertakings; free wiring; supply in bulk.

Widnes.—Application by Corporation for alteration and amendment of 1901 and 1904 orders. New compulsory area. Transfer to Salt Union Co., Ltd., or other company.

Widnes.—Application by G. H. Cox and H. J. Falk (Colonial House, Water Street, Liverpool) for provisional electric supply order.

Yorkshire Electric Power Co.—Alteration and regulation of capital and borrowing powers of the company.

(b) Electric Tramways and Railways.

Baker Street and Waterloo Railway.—Subway at Oxford Circus. Agreements with other railway companies as to use of stations, &c. Various other powers.

Bradford Corporation.—Very numerous powers are applied for, from the extension of powers to carry goods on tramways, to run trackless trolleys, and to supply electricity in bulk outside the city, to the suppression of indecent literature.

Charing Cross, Euston and Hampstead Railway.—New short lengths of railway at Charing Cross and Victoria Embankment. Agreements with other underground companies. Powers as to capital.

Devonport and District Tramways.—Repeal or amendment of Acts. Power to British Electrical Federation, Ltd., to manage the undertaking as sole director or otherwise, &c.

Great Northern and City Railway.—Extension of time for completion of railway and subway authorised in 1902.

Halesowen Light Railways.—Application to Light Railways Commissioners by company, for extensions to railways.

Handsworth.—Application by U.D.C. for further powers in respect of electrical undertakings, including several new tramways.

Leeds Corporation.—Provision and running of trackless trolley omnibuses in Leeds, Armley and Bramley, and powers incidental thereto.

London County Council.—Construction of new and reconstruction of existing tramways. Extension of time for powers under 1903 Act.

London Electric Railway Amalgamation.—Transfer and vesting of powers and amalgamation of Baker Street and Waterloo; Charing Cross, Euston and Hampstead; Great Northern, Piccadilly and Brompton Railway Co. Dissolution of transferred companies, termination or alteration of guarantee of interest by the Underground Electric Railways Co. of London, Ltd.

London United Tramways.—Extension of time for completion of tramway in Richmond, and incidental powers.

Mersey Railway.—Extensions of periods for payment of interest on certain debenture stocks; various other provisions, including allowances for depreciation and renewals of electric plant, rolling stock, &c.

Metropolitan District Railway.—Capitalising arrears of dividends, and various powers.

Metropolitan Railway.—Extension of time for authorised work; construction of subways; various powers.

Milnrow.—Application by U.D.C. for power to construct and work tramways.

Morecambe Tramways Co.—Reconstruction of tramway; use of mechanical power; provisions as to capital; dissolution of company.

North and South Shields Electric Railway.—Extension of time for completion of railway and works. Additional capital, &c.

North-East London Railway.—Extension of time for subscription of capital, commencement of works and construction of railway. Agreements with Metropolitan Railway. Amendments of Acts.

Nottingham Corporation.—Extension of time for construction of tramways authorised in 1905; powers to construct further tramways.

Rawtenstall Corporation.—Construction of further tramways.

Rhondda U.D.C.—Construction and working of tramways; mechanical power.

Southampton.—Corporation is applying for further tramway powers; also for powers to provide and fix electrical fittings.

Wimbledon and Sutton Railway.—New company. Agreements with the Underground Electric Railways Co. of London, or other authorities, as to supply of electricity for working railway.

Peat as Fuel.—The central station on the moors in East Friesland, to which reference was made in this journal several months ago, was opened for public supply on November 15th. Peat is used as fuel, and it is calculated that the quantity available is sufficient to raise steam for a period of 100 years. The cost of establishment has amounted to £150,000, the plant is capable of dealing with a demand for 5,000,000 KW.-hours per annum, and the distributing network extends over 150 miles. Various contracts for supply to local authorities have been concluded, but the dockyard at Wilhelmshaven is not connected with the mains, as the erection of two plants for dock and lock works was projected before the station was built, and has already been carried partly into effect. On the other hand, the station affords a supply to the harbour works at Emden. It is expected that the contemplated tramways at Wilhelmshaven and Rustringen will be operated from the moorland station.

Carbide of Calcium Syndicate.—Reports of a contradictory character are in circulation in Germany regarding the question of the constitution of a syndicate of producers of carbide of calcium in various countries. We quoted last week the reported establishment of a syndicate for the regulation of production and prices. On the other hand, a Frankfort newspaper learns from well-informed circles, that doubts exist as to the actual constitution of a syndicate. Surprise is also expressed that important producers, such as the German, Swiss and Tyrol interests, know nothing of such negotiations, whereas an understanding without the inclusion of these works is scarcely conceivable, having regard to the large proportion which they possess in the aggregate output.

NOTES ON TRADE ABROAD.

The Future of Canada.

We commend to the serious attention of all our readers who take an interest in the future of Canada, and especially those who desire to gain from its industrial development, the important question of British and American investments in Canadian undertakings. There is a vast difference between the American and British manner of investing there. The American when he puts his money into the country goes along with it and establishes a business—perhaps a branch of a similar works in the States—and he stays there either altogether or sufficiently long to set the new concern on its legs, so that an efficient American or Canadian staff can run it for him. British investors put their money by the million into Government bonds, municipal bonds, railway stocks, and so forth, yielding, say, 4 per cent., and remain at home, leaving someone else to get a bigger benefit by their direct effort; thus we too often withhold that important British influence which our active presence and enterprise would exert upon the conduct of affairs. Of course, many of our investors are merely wanting a safe investment for their money, have little or no knowledge of, or interest in, industrial affairs, and have no personal necessity to worry themselves, so long as they can gain a sure and steady 4 per cent. We are not going to suggest that these should refrain from so investing, for Canada needs all the money it can get for the enormous development works of a public kind that are in progress and in contemplation. But if only those who know something about British industry and British manufacturing were to commence active operations over there, we have little doubt that they could influence a good deal of capital to flow into their purposes. It is good as far as it goes to have British money developing the country, but it needs also British capital accompanied by British effort in industrial and manufacturing work if a reasonable proportion of British-leavening spirit is to be maintained in the future.

We hope that the electrical manufacturers of this country, as the result of their increased attention to the market, and the opening of offices and the appointment of agents in the chief centres of the Dominion, will be able to do a far better business than they have been doing, in goods made in our own factories here. But it may be that in some cases where manufactures are known to be suited to the Canadian requirements, some of our manufacturers may find it good policy to consider the establishing of branch factories in Canada. To compete with the widespread American influence in electrical affairs in Canada—partly consequent upon the investment of American electrical capital in setting up factories which made available certain lines of manufactures whose ready presence in such a country had a good deal to do with the creation of a demand and subsequent preference for them, about which we have heard something—our firms will need to carry large stocks. When that has been done and has succeeded, it will be possible to see whether the prices obtainable leave a larger profit than would ensue if works, operating with higher priced labour, were established there. American electrical factories went over the border, because of the tariff on their exports from United States works, because they by their closeness to the country more speedily recognised the greatness of the electrical opportunity, and we believe also because of the railway charges. Exports from this country get in more favourably than do others, because of the preferential tariff, but they have a sea journey, and perhaps a long river or overland journey, as compared to the States railway journey. Manufacturing costs here are lower—labour being cheaper, and the workman's output superior—than in either the States or Canada, if we turn things out in sufficient quantities. On the other hand, we suffer in the matter of time of delivery under the disadvantage of distance, whereas the States factory may be not far off, and can thus give a quicker delivery. The presence of the American manufacturer in Canada is an accentuation of our difficulty where time is of any consequence, but in lines that we can carry in stock, or where time is only a secondary matter, we ought to be favourably placed. All these and other pros and cons have to be considered, and we shall not be surprised if some of our electrical and engineering manufacturers think it better and more profitable policy to manufacture in Canada than to export from England, after they have succeeded as the result of their present more aggressive policy in establishing extensive business connections there.

We have been led to write the foregoing by an article, entitled "A Word to British Investors," appearing in our always entertaining contemporary *Canada*. Herein figures are quoted, showing that approximately £46,000,000 of American money is invested in Canadian *industrials*—mills, timber, mines, lumber, packing plants, implement distributing houses, &c. The *Monetary Times* is quoted thus: "In certain industrial lines the United States have gathered their own industrial fruits. Britain has left the gathering to someone else, and has had to pay the middleman. It is a question as to whether 4 per cent. and no worry is better than 8 or 10 per cent. and the comparatively trifling worry as to the future of a country such as Canada."

The British investor does a good deal of this sort of thing in other parts of the world as well as Canada. New York has only got to ask the London financial world for dollars by the million, and it gets them, at a fair rate of interest, but its people run over the Canadian border with many millions more to lay out in industrial operations, and secure a far bigger yield. Our investors will find the necessary capital to enable German manufacturers to carry out the electric power supply to the Rand, but our banks will not furnish the money on reasonable terms for strengthening the hands of the British manufacturer so that he can make the profit on the making of the plant, &c., giving work to our people while still leaving the investor the opportunity of investing in the undertaking itself. The writer in *Canada* concludes: "It is all important that British sentiment should predominate. If more British capital with British control found its way into Canada, not only would trade between Great Britain and Canada be increased, but British sentiment in the Dominion would necessarily be fostered."

It may be thought desirable that our great engineering firms should wait before taking so important a step as we have suggested until a greater degree of actual development, creating an immediate and continuous need for them, has been reached. In the meantime the American financial hold and industrial control is getting a firmer grip. It is easy to wait too long, allowing others to become masters of the situation while we await the arrival of more favourable conditions. However, there is an immediate need for adopting an aggressive policy of appointing local agents and opening up branch offices, whatever else may have to follow in the course of time.

The British Position in India.

One of our Indian correspondents writes as follows regarding our recent survey of the electrical market in India:—

"Your extremely interesting article in the current number (October 29th) of the Electrical Review will be read with interest by electrical importers in India. The writer of 'Notes on Trade Abroad' has hit the mark when he says that Consul-General Michael's reference to electrical 'machinery made in the United States as being considered by Indian electrical engineers to be the best in the world' is a trifle American in its mode of expression. Your statistics quoted from Government Blue-Books prove that the value of American electrical goods imported here is small, as compared with British made, and no unbiased person will claim that Americans make the 'best in the world.' That their electrical gear is good no one can gainsay, but for some reason—it may be the loyalty of the native to the Union Jack—the Americans have up to now failed to get a grip of the Indian electrical market. That they are gradually insinuating their way is a proposition that British manufacturers cannot afford to ignore. In Mysore, Kashmir, and to a small extent in Nepal, a lot of American work is being done; and as one successful contract leads to another it behoves our home manufacturers to keep a keen look out ahead for orders to come. In regard to Afghanistan, it is a tradition of this kingdom to remain aloof and isolated and keep its affairs secret: but the recent visit of the Amir to India has put him in touch with modern ideas and with fruitful results as regards thing electric. One of the large Indian electric firms has secured a handsome order for all

sorts of electrical equipment—palace lighting, motors, generators, turbines and a long-distance transmission line. To thoroughly investigate the possibilities of a local coal supply, the Amir has employed a coal mining expert to make exhaustive reports on the condition of existing coal mines in his kingdom.

Bengal coal fields.—Two years ago, during a period of abnormal activity in the coal mines of Bengal, a central power transmission scheme was keenly discussed and would probably have taken effect by now, but for the bad seasons which followed. For the past 18 months most of the mines have been curtailing their supply purposely because of the small demand, and a few of the less important mines have ceased work altogether. Now there are certain signs of a better demand and more prosperous seasons in consequence. Cheaper and more up-to-date methods of hauling and coal-cutting are sure to be sought for, and English manufacturers who make a speciality of electrical machinery for mines should leave no stone unturned to push their material. Certain German firms are already actively canvassing both by representatives on the spot and by means of cleverly-worded articles in Indian papers in which their specialities are made prominent. *Verb. sap.*"

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The First Telephone Switchboard.

Referring to "W. E. B.'s" question as to "When and Where the first Telephone Switchboard was erected in England?"—It is well known that for lack of opportunity of sifting evidence, several gentlemen claim "the honour of bringing the first pair of speaking telephones to this country," and it is probable that for similar reasons there may be several "first switchboards."

As a contribution to the discussion, I quote the following from a paper which I read at the Institution in 1895 on "The Origin and Development of the Telephone Switchboard":—"It will be remembered that telephone exchange business was started almost simultaneously in London by two different organisations—the Bell and the Edison Companies. The Edison Co. had an experimental exchange at 6, Lombard Street. It was publicly opened on September 4th, 1879, with 10 subscribers connected. The switchboard then used formed the subject of the first specification for a telephone switchboard in the English Patent Office (No. 3,794, September 20th, 1879). The elevation drawing attached to that specification is here reproduced. The switchboard used by the Bell Co. in their first exchange at 36, Coleman Street, was of a different character. The sketch shown is made from a photograph in my possession." (*Journal* of the Proceedings of the Institution of Electrical Engineers, Vol. XXIV).

In the discussion following my paper, Mr. J. G. Lorrain stated that the Manchester Exchange, started by him in July, 1879, was about a week or a fortnight earlier than that in Coleman Street.

The switchboard at Lombard Street was in operation before the public opening, but the exact date of its setting up I was unable to remember, and, like that at Coleman Street, have been unable to ascertain. It was a neck and neck race between the two companies, and there cannot have been much difference in time, if any. The date of installation of the board at Manchester I do not know, but Mr. Lorrain indicates July.

There must of necessity be difficulty in determining the exact date of the erection of the various boards. But if obtained, it does not determine much. To place a switchboard in an office and illustrate its operation by instruments in the same building was not a difficult matter, even in those days. To connect up a number of distant places and interconnect them on the exchange system was a different matter. If "W. E. B." will alter his question to "When and where was the first public operating exchange?" the inquiry may be more fruitful.

Your issue of September 15th, 1879, mentions not only Coleman Street, but also Lombard Street in the same article, whilst a note intimates that "an attempt is being made to establish a telephonic exchange in Manchester on the American plan."

Your issue of September 1st, 1879, has a note stating that "The Telephone Co. are about to introduce Bell's telephone into London on the exchange system."

The evidence of the public opening of the Edison Exchange will be found in an article in the *Times* of September 6th, 1879, which mentioned the localities of the offices connected. "The Telephone in Principle and Practice: Its Origin and Development," by J. E. K. (David Bogue, 1882), gives the names of the 10 subscribers, of which the *Times* itself was one and the undersigned another.

If Mr. Poole and Mr. Lorrain will submit similar evidence for Manchester, and Mr. Fletcher can be prevailed upon to investigate the claims of Coleman Street, perhaps some conclusion may be reached.

J. E. Kingsbury.

London, W.C., *December 6th*, 1909.

Electric Ignition.

I was rather surprised to see the paper on Magnetos read before the Institution of Electrical Engineers. When perusing different parts of it one has to ask if this was intended for gas, motor, or boat engineers, motorists, or what!

A description of machinery, as printed in catalogues, neither satisfies the engineer nor delivers anything novel to the layman. Jumping from gas engine ignition to petrol firing, high and low tension, coil, magneto, &c., and without any reference to conditions, demands, machinery and so forth, confuses more, and acts only harmfully on this already very poorly understood subject. However, one good thing has been gained, viz., a little more knowledge of the foreign firm whose courtesy has put their catalogues in the hands of Mr. Wilson.

Subjects such as cycle pattern magnetos of the high and low-tension variety, single twin, V type, two-cylinder machines, stationary and revolving armatures, self-starting devices, advance and retarding mechanism, gearless multi-cylinder magnetos, distributors, lagging, insulation, &c, were really required, and not the primitive and "actually known by every engineer machines" described.

H. Armature.

Heston and Isleworth Pupilships.

On opening my Electrical Review this morning, I was astonished to find an extraordinary reference to ourselves in your leader columns, and, with many instances in my mind of your fairness, general accuracy and good taste, I can only assume that you have printed the paragraph sent in probably by some local correspondent, without fully appreciating its contents.

Such phrases as "whose electric lighting venture has not hitherto been a conspicuous success," "the station will in future be run principally by unpaid labour," and "we shall watch with interest the future financial results which it is to be hoped will show to better advantage than those hitherto returned," seemed more suited to the requirements of a local and unfriendly "rag" than to the columns of our premier professional paper.

The question exercising your paragraphist's mind was evidently the Council's scheme of offering pupilships in our various departments to sons of residents, and as the general conditions of this scheme are very plainly set out in a pamphlet issued by the Council, which can be obtained gratis on application, your correspondent's distortion of the facts would appear to be deliberate.

Briefly, the Council have thrown open to competition by public examination *one* pupilship in each of the four departments of the Council, viz.: clerk's, surveyor's, medical officer's and my own. A second vacancy will arise in 1911, and a third, and final, in 1913.

The positions are limited to sons of residents—they are certainly not limited to "lads attending the secondary

schools"—and it is difficult to see any logical reason why pupils appointed in this manner should be in any way inferior to those appointed by influence or for a monetary consideration.

Your correspondent "*presumes* that it will be the duty of the chief engineer to father these lads," and he also "*does not know* if it is proposed to increase the remuneration of the chief engineer for the additional duties involved." Instead of "presuming" and "not knowing," our literary friend might have made a few civil inquiries from me to satisfy his curiosity. He would, at all events, have received a courteous reply. On one point, however, he is emphatic, and commits himself to the definite statement that "the station will in future be run principally by unpaid labour." Oh, happy station! But, unhappy reporter, he has not sent you all the news. Has he not heard that we are getting our coal given us and are running a bazaar to pay for the E.R.S. and repairs?

But, seriously, Mr. Editor, how came the proof reader to pass such a ridiculous statement as that?

Your correspondent's facts are bad, but it is a great consolation to us to know that he has a good heart—he means well. Alas, that so many people should be so eager to keep the well-known road in such good repair. He will "watch with interest," and he "hopes" that our financial results will show to better advantage than those hitherto returned. Well, I hope so, too—they cannot be too good as far as I am concerned, but when, after only four years, we show a *gross* profit of £3,652 on a revenue of £6,699, and a capital of £56,771, added to which, on an output of only just over half-a-million units, our works costs are only ·89d., and our total costs 1·31d. per unit, with all due modesty, we do not consider that we are taking such a very poor place in the records of electricity supply authorities.

I must apologise for emerging from my natural obscurity, but an attack by insinuation is so foreign to your columns, that I feel sure you will desire to be placed in possession of the truth as soon as possible.

Percy E. Rycroft,
Engineer and Manager.

December 3rd, 1909.

[We have to thank Mr. Rycroft, the engineer and manager of the Heston and Isleworth U.D.C. Electricity Works, for a copy of the conditions of pupilships and apprenticeships which the Council are offering to the sons of residents. He takes us to task, and justly so, for basing our remarks of last week on the incomplete information of a local correspondent, and we regret that before commenting on the scheme, as we understood it, we did not communicate with him.

As to the financial success of the undertaking, this is no doubt largely a question of point of view, and Mr. Rycroft points out that his department showed a gross profit last year, the fourth year of operation, of £3,652 on a capital of £56,771. We find, on looking up the records, that after paying interest, and allocating to sinking fund an amount equal to 2·58 per cent. on the capital, there was a net balance on the right side of £80, and we were guilty of characterising this as "not a conspicuous success."

We apologise as to the pupilships; the pamphlet sent to us puts the matter in a very different light to that in which it appeared from the notes previously received. The scheme embraces three pupilships in each of the following departments, viz.:—The Clerical, Health, Engineering and Surveying, and Electrical Departments. Each pupilship will be tenable for five years, and an appointment will be made in each department in each alternate year. The qualification of candidates are that they shall be not less than 14½ nor more than 16½ years of age, and must have been resident with their parents or guardians within the Urban District of Heston and Isleworth for three years prior to sitting for the extrance examination. The examination will be held at the Council House, the subjects including arithmetic, geography, précis-writing, short essay, English history, and general knowledge (oral).

The pupilships will in all cases be awarded on the recommendations of the examiners, and such recommendations shall be according to merit.

The articles of pupilship may be cancelled at the expiration of six months if the head of the department should report that the pupil has not made satisfactory progress, or is not suitable for the office in which such pupilship is held.

No salary will be paid during the first three years, but in the fourth and fifth years the pupil receives a salary at the rate of £26 and £39 respectively.

The pupil will be required to pursue the course of study necessary to making him an efficient officer of the department to which he is attached. In the electrical department the subjects of study specified are "Machine Construction, Applied Mechanics, and Electricity and Magnetism."

The Council accept no responsibility in regard to any pupil, nor do they undertake to give him employment at the termination of his articles.

As the pupil is required to enter into articles of pupilship with the head of the department, we take it that Mr. Rycroft's pupils will at the end of their time be entitled to style themselves "electrical engineers." It will be observed that no technical qualifications are required before entering into articles, nor is the study of technical electricity a requirement during pupilhood. We should scarcely have thought that "Electricity and Magnetism" would provide the necessary mental equipment, and were under the impression that workshop practice was considered essential to the proper training of the electrical engineer.—Eds. E.R.]

The Steady Job.

The philosophy of the ordinary man.
With acknowledgments to "A. P. C."

Some wise man once said that the man of genius is as a rule only about 1 or 2 per cent. genius and the rest ordinary man. Similarly it may be said that the enterprising man is, as a rule, enterprising only in a few directions, most of his ideas going according to custom. Equally true is it that, of the people who at any time make up a nation, only a small proportion are highly enterprising, according to the age they live in, while the vast bulk are just ordinary, humdrum people.

Consequently, however desirable we may think it to make the world a place suitable for the few who exhibit great enterprise, we shall not succeed in doing so without taking the mass of ordinary people into account. After all, the problem of living is not for the talented alone, but also for the commonplace, and as these are by far the larger number, it is practically certain that any attempt on the part of the talented to set up a social system suitable to themselves, without consideration of the ordinary person, will result in the mass of ordinary men swamping the few talented.

Your most enterprising person likes to have an underlying basis of security even in his wildest speculations, and (unless he is a lunatic) some tolerable prospect of reward, while it is commonly to be observed that the most enterprising will be found among those who have acquired tolerable security, insecurity being unfavourable to enterprise except in the merest handful of cases. "If a man does not gain personally by any deed of his own, he will not take the trouble to do it." That is, it is just the fairly secure prospect of an adequate reward that calls out diligence in the ordinary man, and it is because hitherto the ordinary person has had fair security of reward for his enterprise in the U.S.A., and because every man has felt that earnest and enterprising endeavour would certainly bring its reward, that that nation has gained the title of enterprising, not in the least because of any suppositious insecurity. There is every whit as much insecurity here as in America.

Anyhow, everyone can't be Lord Mayor of London, no matter what effort they make; by far the most jobs are ordinary routine jobs requiring simply the faithful and punctual performance of definite duties, and with such as these most people will have to content themselves.

As for "not counting in the evolution of things," it is just the ordinary man who does count, helping or retarding according as he favours or rejects the ideas men of enterprise put before him.

Above all, one may dispute the wisdom of enthusing over the idea of the enterprising supermen "trampling down" their weaker brethren—or even killing them out. The fact is that your enterprising person is largely dependent upon ordinary persons for the very opportunity to develop and exhibit his quality. Who builds his house, weaves his

clothes, grows his food? Who cleans his house and prepares food to sustain him in the intervals of his exhibitions of enterprise? The ordinary person. If the enterprising person wants to embody the fruits of his enterprise, say a patent machine, in a form useful to man, who does most of the work—the casting and working up of the metal, the necessary advertising and putting it on the market. Ordinary men do most of it. But this is not the limit of his and their mutual inter-dependence. Modern medical science is arriving at the conviction that the chief predisposing factor in disease is unhygienic surroundings or mode of life. These supply a soil favourable to the propagation of disease germs. Now the ordinary person, when thoroughly trampled on, habitually gets into such conditions as these, and then by reflection, so to speak, returns any infection he may get in no small measure to the enterprising parties now on top. In other words, the process of trampling injures the trampler only less than the trampled; so that any attempt to evolve a race of enterprising supermen at the expense of the ordinary man recoils on the head of the former, and only evolves a race of super-savages brutally fighting in the jungle of bricks and mortar that constitutes a modern city.

John Smith, *ordinary man.*

The article by "A. P. C." in your issue of November 18th, suggests that there may be other points of view than that taken by the writer of that article, and it may be worth while considering some of these.

If the competition for permanent jobs is as keen as is admitted, it must mean that some at least of the supermen of this generation are desirous of obtaining them and recognise their advantages, and if the illogical idea of a race of supermen could be realised, we should have these supermen fighting with superhuman energy for the super-permanent jobs, and the state of affairs would relatively be the same as at present.

It must be obvious that the idea of a race of supermen is illogical, because, if all men reached that stage, they would not be supermen, but merely men in a more developed stage than at present; and Max Nordau, in his book, "Degeneration," states—and, indeed, the mere statement is sufficient—that it is not the supermen of a race that are perpetuated, but the average of the race; and natural evolution is the gradual improvement of the average, and not the perpetuation of the freaks.

There is also a well-founded belief that the mental capacity of the individual has not appreciably—if at all—increased during the period since Homer wrote, and the ancient Chaldean astronomers made their observations and deductions; but the knowledge possessed by the individual has greatly increased, and the first men in the now abolished Cambridge Tripos Examination may be safely considered to have a greater knowledge of mathematics than Isaac Newton, though their mental capacity may be less, and similarly, the knowledge of medicine of the newly qualified student may be many times greater than that ever reached by Harvey. From these considerations it is safe to assume that the suggested race of supermen would only be the superiors of the present race in knowledge, and not in mental capacity or energy.

The impossibility of breeding a race of supermen is emphasised by the well-established fact that men of genius have smaller families, if any at all, than the average man, and it is rare for any of the children of supermen to be themselves supermen, and still rarer for any of the third generation to be above the average in mental capacity.

The exception taken to the existence of the mediocre men is untenable, as there is a vastly wider field for the mediocre in the world than for the supermen, apart from the fact that the supermen would require to be clothed and fed, and carried from place to place, by factories, farms, locomotives, ships, and if you will, airships, which could, and would, be run by the mediocre amongst the supermen.

Again, a vast amount of work is done—and well done—by the average or mediocre man without any great advantage of education, and, indeed, in the engineering world we are familiar with the vast array of good engineers, draughtsmen and others who, in relation to the superman, can only be classed amongst the mediocre, and yet they have added their quota of little improvements which go to make up the perfection of modern machinery, civil engineering appliances, &c.

There is, further, the fact that some of the supermen in some walks of life at least, such as commerce, finance, &c., are not always the most cultivated and pleasant companions, and, indeed, sometimes their position as supermen is entirely due to the employment of their energy and capacity to circumvent and outdo their fellow men, and in such cases it cannot but be admitted that their nature has suffered some loss, some narrowing, due to their concentration on the one object which they deem worthy of pursuit, and such men would be no advantage to the suggested "Utopia." It is a very true though unpleasant thought that all gain implies some loss, and exceptional success in any one direction is but rarely unaccompanied by a narrowing in others; and in the rush of life, as lived in the more highly organised nations—such as this country, the United States, Germany, &c.—the supermen who attain great eminence are generally those who devote the whole of their thoughts and working hours to the furthering of their aims.

It is to an extent true that the average responsibility in a permanent job—*i.e.*, a Government, municipal or similar appointment—is less than in a commercial position of similar standing; but this is, to a considerable extent, due to the fact that the permanent jobs are filled by men who have been longer in their position than the average time in commercial life, and the jobs themselves are the development of many years; and as a result, the shares of responsibility have been more completely apportioned out, so that the routine work is done by the juniors, and the seniors are left more free to attend to matters out of the routine; and it should not be forgotten that some—and in these days of examination a good many—of the positions, junior and senior, are held by men who at least when they were young were supermen in the full sense of the word. Perhaps the principal difference is that in a commercial firm each department is generally run by one responsible man with a number of cheap juniors, while in the permanent post we may get men of any age, some of whom, if in commercial life, as they got older, would have to move out as heads of other departments, or be moved out, because for the work which they were doing, cheaper and younger men would suffice. In the only comparable case, *i.e.*, where the commercial houses are sufficiently large, something of the system as adopted in public offices is followed, and the various departments have separate heads, responsible to the general manager, and through him to the proprietor or directors.

Further, the existence of the supermen who devoted their energies to the development of the modern standard of sanitation, ventilation, education, hospital treatment, &c., has had the direct result of keeping alive immense numbers of the weakest and most incapable of the human race, and is directly hostile to the development of a race of supermen, and a very striking case is that of our asylums where the mentally and morally deficient are kept alive and so far "recovered" that they are discharged to return to their families, only to be readmitted after a short period, sometimes only a matter of months.

S.

Daimler Engineering Scholarships.—The Daimler Motor Co. (1904), Ltd., have decided to continue their offer of Works Scholarships for 1910. These consist of one Major and four Minor Scholarships. Full particulars of the conditions for gaining these scholarships may be obtained on application to Prof. W. Morgan, B Sc., Manager, Pupils Department, Daimler Works, Coventry.

Two Remarkable Records.—We learn that an engineer of one of the largest public institutions in the country has informed the makers that a Sunbeam carbon lamp of 230 volts, 5 c.p., has burnt continuously for over 18,500 hours, and only then failed through receiving a severe knock, which damaged the filament. We are informed also that two Sunbeam metal lamps have burnt for 5,700 and 4,000 hours respectively on a street lighting circuit, and are still burning satisfactorily and with but slight diminution in their candle-power.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Extra-High-Tension Cable.

Messrs. W. T. Henley's Telegraph Works Co, Ltd., of Blomfield Street, E.C., have recently manufactured for Messrs. Marconi's Wireless Telegraph Co., Ltd., a remarkable cable for use at their Clifden and Glace Bay Stations. The cable is 0·02 sq. in. cross-section circular twin, insulated with impregnated manila paper, lead-sheathed and wire armoured, as shown (full size) in fig. 1; it will be used to convey current at 40,000 volts pressure from the power house to the transmitting house, the current being generated by Thury dynamos, connected in series, for charging accumulators.

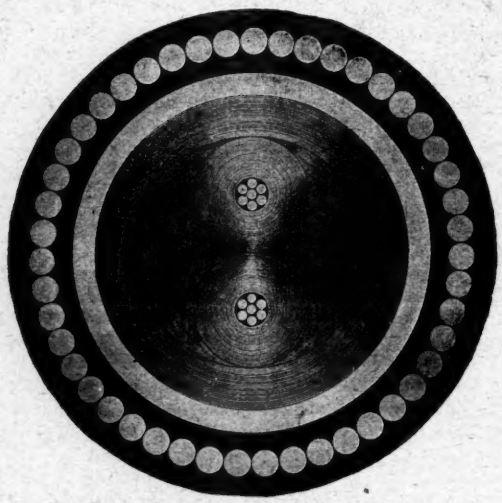


Fig. 1.—Extra-High-Tension Cable.

A large factor of safety was required, and the purchasers specified that the cable was to be tested before delivery with a pressure of 56,000 R.M.S. volts between core and core, and between cores and lead; Messrs. Henley's, not content with this, further subjected the cable to a pressure of 130,000 R.M.S. volts for 10 minutes, a drastic test which the cable successfully withstood. This very high pressure was reached by gradual stages without any interval of rest for recovery between the tests, as follows:—

75,000	volts	for 5	minutes.
90,000	,,	5	,,
100,000	,,	20	,,
115,000	,,	30	,,
130,000	,,	10	,,

During the tests the cable was bent in two places to a radius of 17 in. These results are claimed by the makers to constitute a record.

B.T.-H. Ampere-Hour Meter, Type MS.

The British Thomson-Houston Co., Ltd., of Rugby, have brought out a new D.C. ampere-hour meter of the mercury type for switchboard use, generally similar in construction to their house

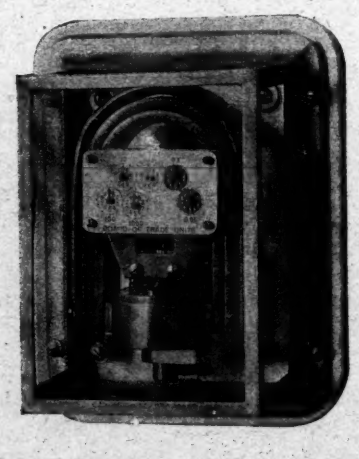


Fig. 2.—B.T.-H. Ampere-Hour Meter, Type MS.

service meter. As shown in the accompanying illustration, the instrument is furnished with a glass and metal cover and is self-contained, so that it can be mounted directly on the switchboard without a sub-base. An external current shunt is provided. The motor consists of a copper cup immersed in mercury in a strong magnetic field produced by permanent magnets. The pressure on the jewelled bearing is extremely light, and the mechanical losses have been reduced to a very low figure. The mercury chamber can be completely sealed and the spindle securely clamped for transportation. All parts are standard and interchangeable, and can therefore be replaced from stock, if damaged.

Large Motor-driven Exhaust Valves.

The advent of the steam turbine, and the added importance which this has given to condensing plant and its accessories, has been responsible for many improvements in the latter. As an instance, exhaust valves, particularly, have increased in dimensions until their operation by power has become a necessity, and for this reason Messrs. Alley & MacLellan, Ltd., of Glasgow, have to some extent specialised in motor-driven valves.

Fig. 3.—Motor-Driven Exhaust Valve.

Our illustration shows one of the firm's standard full-way wedge gate valves, arranged for operating direct through worm-gearing by a 5-B.H.P. three-phase squirrel cage 50-cycle motor running at 610 R.P.M.

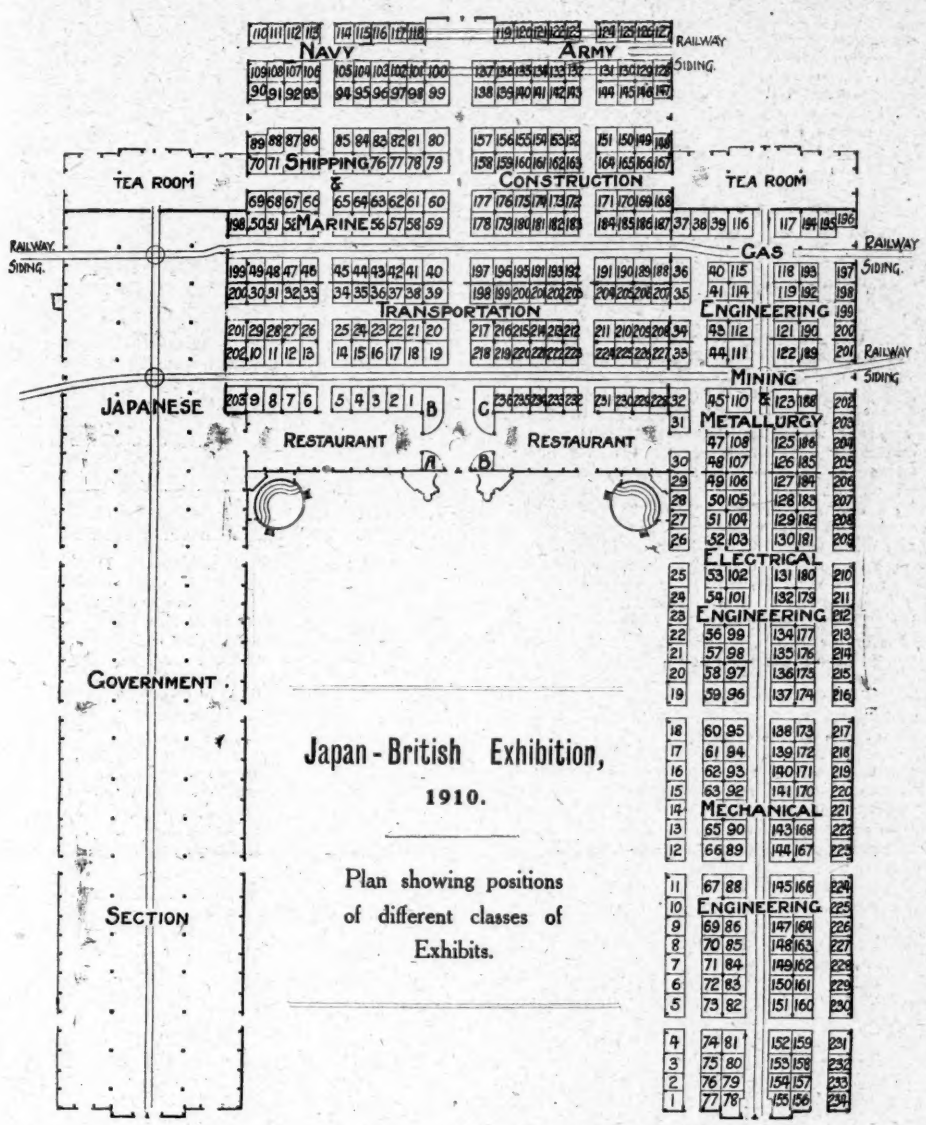
Automatic starting and cut-off switches are provided, and an automatic stop is fitted to the bottom of the valve body to prevent over-running, should the cut-off switches by any means fail.

Such valves are made in sizes up to 76 in. bore, the larger sizes being fitted with patent anti-friction rollers and machined guides.

Platinum.—Some time ago representations were made to the Russian Government with the object of creating a kind of State monopoly in platinum, particularly in regard to the mines in Nishny-Tapil, which produce about three-fourths of the output of this rare metal in that country, but the proposal was not entertained at the time. It is now reported that the negotiations with the Government have so far proceeded on the part of the platinum ore producers that a scheme has been prepared by the Russian State for making advances on the ore, and that it will shortly be submitted to the Ministerial Council for decision. This action leads to the conclusion that the Government has hitherto not taken any measures to counteract the speculation, but rather that the delay in arriving at a conclusion will make the suppliers of the metal become still more reserved, and cause a scarcity and a further forcing up of the price. It is, however, certain that the conditions of the market have become extraordinarily strained. Apart from isolated exceptions, it is stated that the consumption of platinum in the past two decades has been subject to no large fluctuations, and that as a consequence the market stands solely under the influence of speculative operations. It is believed that the stocks of crude ore held by the Compagnie Industrielle du Platine, of Paris, now amount to 6 tons, a quantity which exceeds the production of one year.

THE JAPAN-BRITISH EXHIBITION.

Following up our reference to this Exhibition in our last issue, we are now enabled to give below a plan of the Machinery Hall, indicating the respective positions which have been allocated to electrical and other engineering exhibits. We give this for the interest of firms in our industry, whom, it is hoped, will be adequately and efficiently represented on this very important foreign trade occasion.



PARLIAMENTARY.

Traffic Board.—Mr. Peel asked the President of the Board of Trade whether the Government had taken any steps to give effect to the views put forward by the deputation from the London County Council to the Prime Minister on November 24th, 1908, with regard to the establishment of a Traffic Board for London; in this connection if he would state what duties were performed by the London Traffic Branch of the Board of Trade, and whether it was the intention of the Government that that branch should be in substitution for the Traffic Board suggested in Part III of the Report of the Royal Commission on London Traffic.—Mr. Churchill replied as follows:—Since the deputation referred to waited upon the Prime Minister, steps have been taken to strengthen the London Traffic Branch of the Board of Trade. The principal duties of this branch, are to study the problem of London traffic continuously in all its branches, to keep the statistics up-to-date, to report upon all schemes affecting London traffic seeking statutory authority, and to make an annual report on the whole subject for submission to Parliament. The increase lately sanctioned in the staff of this branch will enable it to undertake certain special inquiries recommended by the Royal Commission on London Traffic, particularly with regard to the roads leading out of London. The branch performs many of the duties that would have been assigned to the Traffic Board, recommended by the Royal Commission, and to this extent it may be regarded as a substitute for it, at all events, for the present. Should an independent statutory board be constituted by a future Act of Parliament, it would find its work materially simplified and facilitated by the work now being carried out by the London Traffic Branch.

Fair Wages in Contracts.—Mr. Hudson, on December 1st, asked the First Lord of the Admiralty whether he would state what action had been taken by the Admiralty to investigate the truth or otherwise of the allegation that Messrs. Armstrong, Whitworth & Co., of Elswick, were not observing the fair wages clause in the payment of certain electrical wiremen in their employ; whether he was aware that the matter had been in negotiation since July, 1908; and whether he would take steps to have it thoroughly investigated and promptly settled.—Dr. Macnamara replied that full inquiries were made of the firm upon the statements originally made, and the conclusion was reached that the Fair Wages Clause was not being infringed. If Mr. Hudson was in a position to submit any detailed particulars applicable to the present time which would suggest the contrary, he would carefully consider them.

F

ELECTRICITY IN MINES: THE MINERS' POINT OF VIEW.

The Right Hon. Thomas Burt, M.P., secretary of the Northumberland Miners' Association, in his monthly circular for November, publishes the following:—

"A short time ago I called attention to the dangers arising from the use of electrical appliances in mines, and I offered some suggestions for the mitigation of such dangers by stricter supervision and better inspection, by the appointment of properly-trained men. Arising out of my comments on that occasion, I have received letters from correspondents on the subject, including some interesting communications from a consulting and inspecting engineer and colliery expert, who is in active practice in these northern counties. Bearing upon practical points, I append a few sentences from his letters. My correspondent criticises the manner in which 'installations' have been carried out in some of the mines.

"'With reference to the general question on Electricity in Mines, as I said in conversation to-day, I should be pleased to have a further talk with you when you have more leisure, as it is a question which I have carefully studied during the past 10 or 15 years, and I have had considerable experience in the application of electricity in mines. I feel strongly on the question of having certificates given to the mechanical engineers of collieries who are in charge of the electrical plant, and who are more or less responsible to the colliery manager and to the owners. Unfortunately, however, the colliery manager is the man responsible to law, and as a rule it is he who takes up the purchase of the installation with the contractors, and many contracts have been let at ridiculous prices to electrical companies, who were anxious to get in touch with mining work, but who had no experience of the operation of colliery electrical machinery, and who, to save making a bad bargain put in the cheapest kind of machinery and plant to do the work. The colliery manager and the colliery engineer, in many cases, had little or no knowledge of electricity, and consequently were quite unable to supervise the work, and even now, although many colliery engineers have a good knowledge of electricity, there are many collieries indeed where the electrician has only a very inadequate knowledge of electricity, and is certainly not competent to design or superintend the installation of electrical plant of any consequence. In some cases, consulting engineers have been employed; but, again, the man appointed has usually been an electrical expert pure and simple, and he has had to gain his mining experience at the expense of the owners, and sometimes at the expense of the workmen.

"'With regard to Inspectors, I would like to point out that it is useless to appoint Electrical Inspectors who are purely electrical engineers. He may have every qualification as an electrical engineer, but unless he has had a very considerable experience in actual colliery work he cannot carry out the duties efficiently. . . .

"'The only other point which I should like to mention is the suggestion I made to you *re* the Miners' Association appointing their own electrical expert. The point raised is this: So far, the owners of collieries have installed through their colliery managers electrical plant, of which the latter has very little, if any, knowledge, and so far as the men themselves are concerned, their interests were not sufficiently considered; but in going through the whole of the accidents that have occurred due to "Electricity in Mines," it is the men who have been the sufferers, and they have suffered in the majority of cases simply because the installation had not been fitted as it ought to have been by the electrical contractors.

"'The Home Office have drawn up special rules, but these rules were drawn up by men who had no knowledge of the conditions of mining, and the result is that many of these rules are bad; in fact, one especially, that one relating to armoured cables is even dangerous. They have recently also appointed a new Electrical Inspector of Mines.

"'The suggestion I have to make is this: That the miners themselves appoint their engineer to attend inquests, and make a report on every fatal accident, and to make suggestions for their prevention, and such a record would not only be valuable to the miners themselves, but would be of material assistance to the owners when installing electrical plant, and would thus do very much to remove the present feeling against the use of electricity in mines, which can do much to improve the conditions of the men underground if properly installed and used.'"

Russia.—A Moscow Consul recently reported: "Electrical engineers have chances to exploit their ability in the Baku district, as electrical power is being instituted in the immense oil fields of that district. Oil-well supplies, such as casing, drilling tools, rig and engineering machinery, and irrigation outfits are in demand."

The Nijni-Novgorod city authorities have been advertising for tenders for an extension of the horse tramway concession.

In a report on the projected development of means of land and water communication in Russia, the Minister of Public Works states that during the next few years there will be built many steam and electric railways, canals, and roads for connecting up all the important places and opening up the interior.

LEGAL.

Hancock *v.* British Westinghouse Co.

At the Salford County Court on Monday morning, before his Honour Judge Wills, application for an award under the Workmen's Compensation Act, was made on behalf of Jabez Hancock, a labourer, of Warde Street, Hulme, against the British Westinghouse Electric and Manufacturing Co., for whom Mr. Cross appeared. The applicant claimed that as the result of lifting a heavy iron box, in company with some fellow workmen, he was seriously injured at the respondents' works, and thereby incapacitated from following his employment under them at Trafford Park.

Mr. Oppenheim said the respondents had raised every possible issue. They claimed that there had been no accident, and if there had been, it had not caused incapacity.

Mr. Cross said that legal notice of the accident was not given until eleven weeks after it was said to have happened, and the respondents were accordingly prejudiced, because it was impossible for them to investigate whether there was or was not such an accident on th day mentioned. Secondly, the applicant worked for eleven weeks after he said the accident had occurred, and he had admitted that this was because he wanted to go on earning full wages. If he had had treatment at once he might have been cured in a week or two. In the third place, it was impossible at so late a date for the defence to get an expert medical opinion as to whether the man's condition resulted from the accident or not. In the result, his Honour awarded Hancock compensation at the rate of 9s. per week from October 2nd last, with costs on the B scale.

Raworth's Traction Patents, Ltd.

In the Chancery Division on Tuesday, December 7th, Mr. Justice Swinfen Eady heard the petition of this company for confirmation by the Court of a resolution to reduce the capital of the company. The company, whose registered address was given as 22, Cooper Street, Manchester, was formed to acquire and exploit a patent electric regenerative control for use on electric tram systems and underground railways.

Mr. Walker, for the company, said that its capital was £30,000, divied into 15,000 preference shares of £1 each and an equal number of deferred ordinary shares, also of £1 each. It was proposed to reduce that amount to £20,625, and thus wipe off £8,839 15s., which had been lost or was unrepresented by available assets. The evidence showed that the company's goodwill and assets did not exceed £18,000, and no dividends had been paid except in respect of the first year's working.

His Lordship granted the petition.

Musgrave & Sons, Ltd., *v.* Bradford Corporation.

In the Court of Appeal last Friday, before the Master of the Rolls and Lord Justices Moulton and Farwell, the hearing of plaintiffs' appeal from a judgment of Mr. Justice Darling in the King's Bench Division, was concluded.

Mr. Walter, K.C., and Mr. Disturnal appeared for the appellants, and Sir Alfred Cripps, K.C., and Mr. Hutchinson for the respondents.

Mr. Walter, in opening the case, said that the judgment of the learned judge appealed from was delivered in three separate parts, viz., on June 17th, 18th and 19th last. The plaintiffs brought the action to recover a sum of about £1,200, the balance of £7,870, the price of a 2,000-H.P. low-speed steam engine supplied by the plaintiffs to the defendants. To the action the following defences were raised: First, the defendants said that it was a condition precedent to the plaintiffs' right to recover that they had the certificate of the engineer of the Corporation, and that, the plaintiffs had not got. Secondly, the defendants said that the shaft of the engine was too weak, which rendered the engine unsafe to work, and caused certain bolts on the flange of the fly-wheel to break. The defendants counter-claimed for £1,996 upon the ground that they had taken out the shaft and replaced it with another shaft, and they claimed the price of the alteration. The plaintiffs' reply to that was that it was a lump sum contract, and that there was no clause in the contract which made the certificate of the engineer a condition precedent to the plaintiffs' right to recover. Further, the plaintiffs said that there was an arbitration clause in the contract which took away the certificate of the engineer as a condition precedent. The plaintiffs further said that the certificate was wrongfully withheld by reason of collusion between the engineer and the Corporation. As regarded the counterclaim, the plaintiffs' defence was that the shaft was not defective, and that the breaking of the bolts was not due to any act on their part, but to the fact that the flange in the armature of the Westinghouse generator was not true with the face in the flange on the fly-wheel. Mr. Justice Darling found that the engineer's certificate was a condition precedent, and that the shaft was not defective. He next found that there was no collusion between the engineer and Corporation, and he further found that the flange not being true was the cause of the bolts breaking. The learned Judge thereupon found that because the plaintiffs had not

bolted the flanges in question together they had been guilty of some breach of contract, and he entered judgment for the defendants on the claim, upon the ground that the engineer's certificate was a condition precedent, and he gave judgment for the defendants on the counterclaim, but as the amount was not large, he thought the parties ought to agree on the amount, and the amount was agreed at £10. Counsel contended that the plaintiffs were entitled to judgment both on the claim and the counterclaim. He said it was clear that the flange which the plaintiffs put on the fly-wheel was absolutely true, and that it was equally clear that the flange of the armature, which was put on the shaft by the Westinghouse Co., was the one out of truth.

In reply to the Master of the Rolls, Mr. Walter said he did not now contend that there had been collusion between the Corporation and the engineer, as Mr. Justice Darling had found against the plaintiffs on the point.

Mr. Walter then contended that under the terms of the contract, the certificate of the defendants' engineer was not a condition precedent to the plaintiffs' right to recover.

Lord Justice Moulton said it was clear, in his opinion, that it was the plaintiffs' coupling which failed.

Mr. Walter said that the plaintiffs were not responsible for that under the contract. It was clear from the evidence that every part of the plaintiffs' work was "dead true." It was owing to the fault of the Westinghouse Co. that a strain was put on the bolts, and that caused the sag. It was due to the fact that there was a defect in the flange of the armature, which caused a strain upon the bolts and forced their heads off. It was the plaintiffs' case that, because the Westinghouse Co. did not do their work properly, the bolts broke.

Lord Justice Farwell expressed the opinion that the plaintiffs should have discovered the defect.

Mr. Walter said that the defect was not found out until long afterwards. The defendants said that the plaintiffs should have insisted upon the armature being taken off and repaired, but that he (counsel) contended, was unreasonable. It took days to do that. No amount of bolting or screwing would make a thing parallel which was not parallel.

Mr Disturnal followed on the same side.

Without calling upon counsel for the respondents, Lord Justice Moulton, in delivering the judgment of the Court, after stating the facts, said he was of the opinion that the decision of Mr. Justice Darling that the getting the engineer's certificate was a condition precedent to the plaintiffs' right to sue was correct, and that as the plaintiffs had not got that certificate when the writ was issued, their claim could not be maintained. Upon the counterclaim—upon this point of the case it was really an appeal as to costs—Mr. Justice Darling had found that the defendants' engineer was wrong in saying that the shaft of the engine was too weak, and that being so he thought the engineer would probably now issue his certificate. His Lordship was of opinion that the judgment of the learned judge must be affirmed, and the appeal dismissed with costs.

The Master of the Rolls and Lord Justice Farwell concurred.

Electrical Apparatus in Fife Mines.

The prosecution of officials of the Fife Coal Co. was resumed before Sheriff Shennan at Dunfermline on Monday. The respondents are Charles A. Carlow and Henry Rowan, described as managers or agents of the Fife Coal Co., and William E. Richardson, certificated manager of the Foulford Colliery. They with charged with having, between April 1st and August 7th, permitted the use at the company's Foulford Pit, Cowdenbeath, of electrical plant and apparatus which did not conform with the special electrical rules, and that despite the fact that on April 30th, Mr. Robert McLaren, H.M. Inspector of Mines, had addressed a letter to the company directing that the plant and apparatus should be made to conform with the rules. Mr. R. S. Horne, advocate, Edinburgh, instructed by Messrs. Ross & Connel, and Mr. G. R. Stevenson, Dunfermline, acted for the respondents. At the last hearing the whole of the evidence for the prosecution was taken, and one witness, an electrical expert from London, was examined for the defence.

Mr. W. E. Richardson stated on Monday, when evidence for the defence was resumed, that he had been eleven years in the employment of the Fife Coal Co., and for ten years had been acting as manager. There was a sufficient and competent staff for the management of the three pits of which he was in charge. Mr. Masterson, H.M. Inspector, visited Foulford Colliery on April 1st, but prior to that date he had had no criticism on the part of the Government Inspectors in regard to the electrical apparatus. On April 1st Mr. Masterson only made a complaint regarding the gate-end box, and made certain suggestions. Witness had never been trained in electricity, and had had no examinations to pass. What he knew he had obtained from experience, and he relied upon Mr. Runciman, who had charge of the electrical apparatus. He thought the gate-end box was quite satisfactory, but as the Inspector had recommended a change, he had ordered it to be done. He made it more or less a rule to conform to the wishes of the Government Inspectors whether he considered that they were reasonable or not. He had had no other communication between April 1st and July 15th from the Government Inspectors, until Mr. Nelson, the Home Office electrical expert, visited the colliery. Mr. Nelson went into the switch room, but said nothing to him regarding it. On the main road, Mr. Nelson found a cut in the cable. It was a very small cut, and if a man had laid the broad of his hand on the cable, he would not have touched the wire. He would have required to use the tips of his fingers before he could have reached the wire. The cut must have been caused by a sudden fall from the roof. This sort of thing occurred from time to time, and there was not a mine in the world that was not subject to falls. He gave orders to have the cut repaired. At another part of the pit Mr. Nelson considered that the cable was too near the passing tubs which he suggested had been rubbing the cable. The cables were put in during the month of April. Witness asked Mr. Nelson what he thought of the electrical installation, and he said he could improve it, but he had seen worse. Witness had never at any time been refused material or equipment for the pit. It had always been made available for him. Mr. Rowan was his agent, and he never had any dealing with Mr. C. A. Carlow.

Examined by Mr. J. S. Soutar, the prosecutor, Witness said none of the oversmen of the three pits were appointed undermanagers, and it was his duty to exercise daily supervision over the pits. He had no view of his own regarding earthing. Mr. Masterson visited the colliery on April 30th, but said nothing about the gate-end boxes. In answer to respondents' counsel, witness said the visit of Mr. Masterson on April 30th was regarding an accident, and he went to the place where it had occurred. He never went near the gate-end boxes.

David Storrock, pit bottomer, said he had never heard of anyone getting an injury by working the lighting switch. He had worked it frequently himself, and had felt no sensation.

Andrew Bruce Muirhead, senior engineer of Selby, Bigge and Co., electrical engineers at Newcastle and Glasgow, next gave evidence. He stated he gave his opinion regarding the matter from an entirely outside point of view. On October 22nd he visited the Foulford Colliery. He found that the switchroom was a completely insulated chamber, and he considered it was an apartment specially arranged for the purpose. The switch used was the one that was most in use in collieries. He had never seen such a switch as that recommended by Mr. Nelson. He saw no necessity for changing the kind of switch which had been in use. The fuses he also considered complied with the rules.

Alex. Anderson, of Anderson, Boyes & Co., electrical engineers, Motherwell, stated that in a well-regulated pit the gate-end box was shifted every day. From the point of safety there was no reason why this should not be done. He had never heard of a single accident from the type of gate-end boxes in the Foulford pit, and his firm supplied hundreds of them. He knew of only one place in Scotland where a gate-end box was fixed, and he knew of only three cases where they were earthed. Because of the difficulty in understanding them, he considered the rules to be a source of annoyance. There were a great many questions opened up when they talked about earthing gate-end boxes.

Hugh Gordon Fraser, electrical engineer in charge of the electrical plant in the Fife Coal Co.'s pits, stated that copies of the rules had been issued to his assistants. He had always obtained all the material he required. There was no fear of any man getting a shock while standing upon the concrete floor of the switch room.

By Mr. Soutar: Practically the same switch was put in the pit with the exception that it was in an iron box. It was put in to please Mr. Nelson, not because the change was thought necessary.

James Fraser Irvine, representative of Edison & Swan United Electric Light Co., Dundee, said he had heard of only one accident resulting from the kind of switch in use.

By Mr. Soutar: Witness admitted that the switch was an article provided for low pressure, but it would do for any pressure.

Geo. Russell, electrician, Aitken Pit, explained that Mr. Nelson had approved of porcelain switches in use at the Aitken Pit about five months ago. He admitted that he showed the switch to Mr. Nelson when above ground.

Charles Carlow, managing director of the Fife Coal Co., gave further evidence, and this closed the evidence.

Counsel having addressed his Lordship, the Sheriff intimated that he would give a written judgment.

Electrical Co., Ltd., *v.* O. H. Thomas, Son & Co.

Mr. E. J. Pollock, as Official Referee, sat at the Swansea Guildhall on Tuesday, to hear an action brought by the plaintiffs against the defendants, who are proprietors of the Glynvi Valley Colliery, near Maesteg, for the recovery of £3,100 for electrical plant for the colliery and goods sold and delivered. There was a counterclaim for the sum of £30,100.

Mr. Abel Thomas, K.C., M.P., Mr. John Sankey, K.C., and Mr. Bowen Davies (instructed by Messrs. Michael, Abrahams, Long and Co., London) were for plaintiffs, and Messrs. B. Francis Williams, K.C., and D. Villiers Meager (instructed by Messrs. Collins and Wood, Swansea) defended.

Mr. Abel Thomas, in opening the case, stated that plaintiffs contracted to supply pumps of a certain capacity for the colliery, and of the counterclaim £24,000 was damages claimed by the defendants for alleged delay, which caused them to decline certain contracts. Plaintiffs were very large makers of electrical plant, and as regarded the alleged delay in installing at defendants' colliery, counsel pointed out that Messrs. Thomas & Co. were not ready when they received machinery to set the same to work. The machinery was delivered within a reasonable time with the exception of one pump, and in that case no damage whatever was sustained. As regarded payment, 60 per cent. was to be paid on delivery, 30 per cent. on starting, and 10 per cent. in three months. It was alleged that the pumping was defective, but counsel pointed out that the work, after erection, was satisfactory, that the defendants were then not only sinking a drift, but working

the coal required. He further contended that the plant was satisfactory in all respects, and that any breakdowns were due to lack of knowledge by the defendants of electrical working. Counsel characterised the counterclaim as ridiculous. The greater part of the day was taken up in the reading of voluminous correspondence between the parties, and the hearing, which is expected to last a fortnight, was adjourned to London.

REVIEWS.

Auto-Transformer Design: A practical handbook for manufacturers, contractors and wiremen. By Alfred H. Avery. London: E. and F. N. Spon. Price 3s. 6d. net.

It is difficult to see how any of the three classes for whom Mr. Avery professes to cater, could benefit by reading this book. The first two would certainly not be impressed, while the average wireman would lay it down with his mind in a muddled state, and with some very erroneous ideas as to the principle and design of transformers.

The first sentence in the preface is typical of the contents of the book—one part makes a statement, and the second implies its contradiction. The descriptive matter is very mixed, and one cannot help thinking that the author is not at home with his subject.

For the purpose of explaining why a balancing auto-transformer is carrying little current on a balanced full load, the author cites the example of two 100-volt dynamos supplying a three-wire system, and states: "Should all the lamps be switched off one side of the system, either A or B, current will flow at 100 volts pressure along that circuit only from outer to inner, as shown by the curved arrows, the others remaining idle." This is an incorrect statement, and at the best could only mislead a novice.

Chapter II goes into questions of illumination, and contains some curious statements. It concludes with the remark that a transformer renders a consumer independent of the supply pressure and enables him to "juggle with it as he pleases." Most consumers would rather not juggle with the pressure.

Chapter III leads off with a weird explanation of the generation of an E.M.F., and in explaining the fundamental equation, the author states: "The factor 4·44 times the frequency f represents the 'root-mean-square' value of the alternating wave form, or the quadratic mean value of the alternating flux, varying four times per cycle."

The root-mean-square value is totally different to the quadratic mean value, and neither of these has anything to do with the flux. μ B curves of Stalloy and Lohys brand sheet-iron are given, but there is no explanation of what these symbols mean.

Densities of 50,000 to 60,000 lines per sq. in. for Stalloy brand sheet are given as good practice, apparently for all periodicities, as "cores designed for this flux density will work perfectly cool for any length of time." Later on in the book Mr. Avery explains that he selected these densities principally for arithmetical reasons. What could be more simple?

We are told that the resistance of a transformer coil is practically of a constant value. Would it were so. It varies sufficiently to upset some of the author's calculations by a matter of some 19 per cent.

Chapter IV is given up to calculations of core densities, number of turns, &c. A table of dimensions for eight different "core" type carcases is given, but there is no mention of the output for which they are intended, and the proportions might easily be improved upon.

It is intended to have windings on only one of the limbs. The cores are of perfectly square section, and round coils are recommended on the score of improved ventilation. It is practically useless to provide ventilating ducts in such very small transformers, especially when they are intended to be enclosed in iron cases, more or less air-tight.

Coils should be shaped to suit the core, and they should be placed as close to the iron as possible if good regulation is to be secured. Cores with longer limbs, shorter yokes, and coils placed one on either side would be more economical and give better results.

There is no mention of the necessity of insulating the laminations from one another, and the iron weights and losses are incorrect, as they are calculated on a unity space factor. With plates ·02 in. thick, 10 to 14 per cent. of the gross area would be taken up with insulation or air space.

Chapter V deals with efficiency calculations, but as the author makes the mistake of calculating the coils at a temperature of 60° F., an error in the neighbourhood of 20 per cent. is introduced, while the error in the iron circuit has already been commented on.

Mr. Avery is not happy in his explanation of "power factor." He states that a wattless current is of no value, as it is delivered at zero pressure, and then produces a diagram which proves that his own statement is incorrect; he should know that the wattless component of the no-load current serves a decidedly useful purpose, at least *while in the transformer*.

A power factor diagram is given, in which the words "apparent current" are used. This is needlessly confusing, as all currents are real whether they are wattless or not.

Chapter VI is given up to constructional details. Two methods of building up the core are discussed, the better one being rejected for the absurd reason that the magnetic flux would have to cross the grain of the iron.

Four joints in the magnetic circuit are advocated in preference to two. Mr. Avery should know that this will result in increased magnetising current and poor regulation.

Enough has been said to indicate the nature of this work. Mr. Avery has taken a certain amount of trouble in the writing of the book, but it is a pity that some technical friend was not given an opportunity of going through the MS. before it was submitted to the printer. The reviewer is afraid there will not be much room for it until it has been thoroughly revised.—F. B. O'H.

Steam Power Plant and Piping Systems. By W. L. Morris. New York: McGraw-Hill Book Co. 1909. Price 21s. net.

The author of this volume is very strong on system, though in his eyes the system of a power generating station consists not in engines and pumps and boilers, but in pipe arrangements. He regards everything through pipes as through a telescope. Now, there are men who have laid out power stations and have put their engines and boilers where they could, and have proceeded to join them up by pipes—pipes on walls, pipes on piers, pipes in troughs and sumps and trenches. Has a pipe to go through a wall a hole must be cut, for it would be presumptuous for a mere pipe to expect a wall to be built with a hole in it on purpose for an expected pipe. Indeed, what right has a pipe to be expected? Pipes are very properly mere accessories, for do we not read about pipes and other accessories? When all the work has been done the engineer very properly takes a holiday while the pipe fitter just puts up a few pipes. Not so the author. Pipes are all to him. Engines and boilers are mere accessories put down for the purpose of maintaining a flow of steam through the pipe system which is the *raison d'être* of the station.

No doubt this is a proper spirit in which to approach a special subject, though a pipe enthusiast is, perhaps, somewhat prone to do too much by way of putting in plant so that a pipe system may be installed. An excellent idea of his book may be got from the chapter headings in the contents index, for there are 31 chapters dealing with the many pipe systems in a station, the feed piping being a system, the artesian well piping a system, the oil pipes to lubricators or bearings a system; and to each system there is its section in other chapters which treat of its details, such as in the live steam system, the branches to auxiliary engines, pumps, fans, whistles, oil cleaners, superheaters, and so on.

In short, the author makes his subject colossal, for pipes dominate, and dwarf all else.

The engineering of a power station is pipework only. No engineer nowadays dreams that his duty to his employer is to design him his engines and boilers. These he has got to buy like so much putty, from recognised makers. But, says the author, it is his duty to lay out the piping systems properly and with care aforethought. What he advises is that an engineer should develop the system and give diameters, but he should leave to the contractors' specialist to determine the location of pipes and branches, for pipe-fitting firms now employ men who have the ability and the special experience to do this. The author begins with diagrams not to scale, showing the systems to be employed and their various connections. It is from these that actual connections are to be designed together with details.

In regard to continuous operation of plant as secured by the piping systems, a distinction is made between absolutely necessary plant, and plant that may be temporarily dispensed with. Thus, a condenser, a heater, or an economiser, are none of them essential to running, though they are all valuable accessories, and should be awarded reasonable safeguards, but not the same refinement as is given to absolute essentials. Thus a condenser may be made to attempt a duty beyond its rating, giving 15 in. of vacuum, which is better than none.

And so the drawings given to the contractor are to show the results to be secured. He is to make the plans to suit his own ideas, and his own materials and patterns, and the engineer is to approve. It seems to us that this is already done in the majority of cases, not only for the pipes, but even for the whole station, for we seem to have heard of an engineer getting out the whole of a station in under a fortnight all by himself, so to speak, ready for tender. Well! these things do happen. The author would regularise them so that there would no longer be any of the present sham and pretence.

The book is full of illustrations of general diagrams and of details, which show, for example, the arrangement of the controlling feed pump, open heater and jet condenser, and the same for the surface condenser. The author approves of the method of removing air from the top of a counter-current condenser, into which the exhaust enters at the bottom, and the coldest tubes are at the top; this notwithstanding that air is heavier than water vapour. He claims that practical records show that there is no error in the method, and his arguments in its favour are well enough. Is it not often the case that practice negatives our stock theories, and points the way to vision of some overlooked factor, as it appears to do in this case?

On pages 68 and 69 an excellent boiler blow-out and wash-out system is outlined, and one of its safety results is pointed out.

But this book is not merely a book of piping; it is a long series of little briefs on the method of working the multiplicity of station accessories—such as lubricators and lubrication systems, the method of applying oil, and the wastage of oil in a circulatory system; on air pressure oil supplying, and so on; at every detail there is a wealth of information, and perhaps, also, of controversial matter, for probably many will differ from the author in numerous matters. But an engineer will profit by reading the book from cover to cover, laborious as the job might be.

The author puts in a word for the all-steel and steel-plate fitting as more reliable than cast-iron, which is unfortunately so much used for pipe-fitting pieces.

The author is an American, and his practice is, of course, largely American, and some of it would be regarded here as obsolete. For artesian or bore-hole purposes, for example, the cup-leather bucket is stated to be universal. Now, this practice is only that of very general pump-makers' gear. The best practice is to use a plain solid bucket of considerable length with numerous close pitched square grooves cut in it. And how is it that an 8-in. casing only admits a $5\frac{3}{4}$ pump barrel? It ought to be easily possible to use a $6\frac{1}{2}$ barrel in an 8-in. casing.

However, we may forgive the author this, for he throws doubt on the use of the pump barrel just locked into the casing pipe, a method only fit for emergency.

The author's explanation of the action of an air lift pump will not be at all generally accepted. Still, his conclusions are right, and everyone can find some blemishes in any book.

This one ought to become the classic on piping systems. It is written by a man who is an engineer and can see things.

BUSINESS NOTES.

Canada.—By an order of Council issued last month, the following appears among a number of additions to the Free List of the Canadian tariff: "Metallic elements and tungstic acid when imported by manufacturers for use only in their own factories in the manufacture of metal filaments for electric lamps."

Bennis Stokers.—In a list of recent contracts received by Messrs. E. Bennis & Co., Ltd., of Little Hulton, we observe the following:—

Long Eaton U.D.C. Electricity Works.—Two high-duty smokeless and gritless coking stokers and compressed air furnaces for a Lancashire boiler. Repeat order.

The Richmond (Surrey) Electric Light and Power Co., Ltd.—Four stokers and compressed air furnaces for Davey-Paxman boilers. Repeat order.

Lincoln Corporation Electricity Works.—Four stokers and compressed air furnaces for dry back type boilers. Repeat order.

Daniel Adamson & Co., Dukinfield (for shipment to India for the Bengal-Nagpur Railway).—Four high-duty coking stokers and compressed air furnaces for Lancashire boilers.

There are in the list of orders numerous other works including paper and flour mills, breweries, spinning mills, soap works, &c., for which Messrs. Bennis have supplied equipments. The firm ask us to state that they will be pleased to show their coking stokers in operation in the boiler houses of well-known firms, to any of our readers.

Dublin Electrical Contractors Busy.—We learn from a correspondent who ought to know, that electrical contractors have more than they can do in Dublin just now, and there are a good many big things still to be done within the next few months.

Consular Notes.—Dutch East Indies.—The Belgian Consul in the Dutch East Indies reports that the official statistics published by the Government do not throw any light on the extent of the imports of electrical goods, electrical machinery being included under the heading "Steam and industrial machinery," lamps and accessories under "furniture," and electrical wire under "copper." Persons competent to judge, however, state that, though the total imports may not be very considerable, they are increasing from year to year. The articles in this branch of trade which are most in demand are telegraphic and telephonic instruments and their accessories, such as galvanised steel wire, insulators, posts, &c. After these come installation work for the distribution of electrical energy in the towns, &c., and material necessary for electric tramways at Batavia. Most of the companies which exploit electrical enterprises in the country purchase their materials through the parent company abroad, but a German firm has obtained a considerable footing in the market, and not only sells its goods but also interests itself financially in the establishment of companies for the production of electrical energy. Its special line is the supply of steam engines for dynamos, and amongst the lighting installations it has recently made are those of Lawang, Soerabaja, and various tea and sugar works. At the present moment the firm in question is making an installation of 1,700 H.P. to supply electrical energy to Soerabaja, and it proposes to extend the distribution in this town by utilising the water-power which is available at a short distance. Another important German firm with an agency in the country has decided on the installation of electric power plant in the petroleum mines at Balikpapan (Borneo). The largest lighting company in the colony is the Nederlandsch Indische Gas Maatschappij, of Batavia. Its electrical installation, which includes boilers heated by means of petroleum residues, was made by a German company. The sale of energy in 1908 amounted to 480,000 KW.-hours at a price of 40 cents for light and 20 cents for power. The number of lamps used during the year was 2,920 of 5 C.P., 30,000 of 8 C.P. (many Osram lamps), 431 of 16 C.P., 820 of 25 C.P., 4,233 of 32 C.P. (most with metallic-filament), 640 of 50 C.P., and 178 arc lamps of from 10 to 18 amperes. The current is single-phase alternating, of 110 volts and 50 periods. The company arranged to lend out electric motors for motive power from January 1st, 1909, but as the industry is still relatively small and the cost of current rather high, this method of exploitation has not given very good results. The lamps, wires, meters, &c., are purchased at the headquarters of the company at Rotterdam, and have been supplied up to the present by Dutch and German houses exclusively. Two methods for securing a trade in electrical goods in the country are recommended. The first is for a syndicate of producers to establish an agency at Samarang and Soerabaja, not only to sell the machines and apparatus, but also to interest itself in new enterprises and even to encourage their establishment. The second is to make offers to the parent companies or buying houses in Europe of the firms mentioned below, and especially to MM. van der Linden et Tèves (dynamos) and the Nederlandsch Indische

Gas Maatschappij (lighting apparatus). It should be added that in order to achieve success, the apparatus offered must be of irreproachable quality, and should compete as regards price with German products. The following is a list of the importers of electrical machines and apparatus in the Dutch East Indies:—

Companies which chiefly exploit Electric Lighting.

Bandoensche Electriciteit Maatschappij, of Badoneng.
Ned-rlandsch Indische Gas Maatschappij, of 71, Bounpjes, Rotterdam.
S dosche Electriciteit Maatschappij, of Batavia.
Electriciteit Maatschappij Medan, of 164, Heerengracht, Amsterdam.
De Algemeene Nederlandsch Indische Electriciteit Maatschappij, which was established on April 8th, 1909, to supply electricity to the Dutch East Indies. It possesses the following concessions:—(1) Supply of electric lighting to Soerabaja, Malang, Sidoardja, Sisir and Batoe, Kasri and Prigen, Bangil, Lawang, Pasoeroean, Singosari, Grisee, Porrong, and Samarang; (2) use of power from various waterfalls; (3) establishment of aerial systems at Soerabaja, Samarang and their suburbs; (4) establishment of electric tramways at Soerabaja and Samarang.

Telephone Services.

The Dutch East Indies Government, besides exploiting the telegraph systems, also works the following telephone systems:—Batavia, Samarang, Soerabaja, Praenger-Regentschappen, Buitenzorg, Djombang, Pasoeroean, Probolinggo, Madioen Soerakarta and Djokjakarta.
Intercommunale Telefoon Maatschappij, of Batavia.
Telefoon Maatschappij Insulinde, of 61, Hugo de Grodstraat, the Hague which exploits the services of Malang, Loemadjang and Bangil.
Pekalongansche Telefoon Maatschappij, of Pekalongan (Java).
Algemeene Telefoon Maatschappij, of Samarang, which exploits the service at Padang (Sumatra).
Blitar Telefoon Maatschappij, of Soerabaja.
Tegalsche Telefoon Maatschappij, of Tegal (Java).
Cheribonsche Telefoon Maatschappij, of Cheribon.
Kediri Telefoon Maatschappij, of Kediri (Java).
Telefoon Maatschappij Japara, of Samarang.

Tramway Companies.

Batavia Electrische Tram Maatschappij, of 259, Heerengracht, Amsterdam; capital 1,600,000 florins, length of line 14 kilometres, power plant 3 units of 200 H.P. each, rolling stock 22 motor-cars and 22 tenders.

Suppliers of Machines and Apparatus.

Allgemeine Electricitäts Gesellschaft, of Berlin, represented at Batavia, Samarang and Soerabaja by M. Maintz & Co.
Siemens-Schuckertwerke, of Berlin, agency at Soerabaja.
Maatschappij tot Woortzetting der Zaken van der Linden et Tèves, Samarang and Soerabaja; buying house, 157, Stadthouderskade, Amsterdam.
De Nederlandsch Indische Industrie, Soerabaja, and 119, Bezindenhout, The Hague.
Carl Schlieper, of Remscheid, Germany, Batavia and Soerabaja.
Handelmaatschappij Het Centrum, Batavia; buying house, 204, Singel, Amsterdam.
Constructiewinkel De Bromo, Pasoeroean (Java).
Maschinehandel voorheer Becker & Co., Soerabaja.
Maatschappij tot Voortzetting der Zaken Ruhaak & Co., Soerabaja.
De Rooy & Co., Soerabaja.

Russia.—The Austrian Consul at Odessa reports that the electrical materials used in that district are chiefly supplied by Russian houses, the heavy dynamo machines, cables, wires, and accumulators from St. Petersburg, and the porcelain goods from Riga. Smaller and lighter dynamos, measuring apparatus, carbons, incandescent lamps, installation materials, &c., come from abroad and chiefly from Germany. Glassware for lighting purposes is chiefly of Bohemian origin, Hungary supplies some incandescent lamps, and England certain kinds of incandescent lamps for vessels.

Holland.—The Austrian Consul at Amsterdam reports that at the beginning of 1908 there were in Holland 4,946 factories with 7,226 steam boilers. The use of electric motors in small industrial undertakings has considerably increased in recent years. On January 1st, 1904, when the municipal central station was first set working, there were in Amsterdam 438 gas engines of 2,553 H.P.; on January 1st, 1908, there were only 246 gas engines of 1,429 H.P. On the other hand, at the end of 1907, there were 1,672 electric motors of 6,783 H.P., and by the end of 1908 this figure had increased to 2,000, or more than 8,300 H.P. There is a considerable opening for electric motors in Holland, the sizes most in demand being those of 2-5 H.P. for small industrial undertakings. There is a certain home production, but as yet this is of no great importance. There are two electrical works at Amsterdam. The Electra supplies two-phase current of 72 or 110 volts, whilst the municipal works supply three-phase current of 220 volts.

A Simplex Competition.—In the Christmas number of *Installation News* to be issued next week, MESSRS. SIMPLEX CONDUITS, LTD, introduce a "picture" competition with the object of popularising their new catalogue, to which we recently referred, and making its contents better known. The competitor has to give a name to the fittings, of which only a portion will be illustrated. Of course he can only do this by making a close search through the catalogue.

For Sale.—Offers are invited for plant, &c., of the SOLIUM ELECTRICAL CO., LTD., metallic-filament lamp makers, Nottingham, of which some particulars are given in an advertisement to-day.

MESSRS. FERRANTI, LTD., are offering a 300-KW. Ferranti-Schuckert steam dynamo, a Ball & Wood engine, and "C. & C." dynamo (120 KW.), also condensing plant, for sale. See our advertisement pages to-day.

Catalogues and Lists.—MESSRS. L. ANDREW & Co., 2, Carr Street, Blackfriars, Manchester.—Leaflet relating to "Palmetto" self-lubricating packing.

MESSRS. BAXENDALE & Co., Miller Street, Manchester.—Forty-eight page catalogue containing particulars of a variety of Christmas presents ranging from a button hook to a sewing machine, with a variety of dolls' houses, boys' bicycles, and other such things which cost us dear at Christmas time—yet somehow we do not seem to mind!

MESSRS. GEO. W. GREEN & Co., Crown Works, Feltham, Middlesex.—Illustrated list describing their trolley standard earthing device as used on a number of tramway systems; also a leaflet drawing attention to a number of their other manufactures, including anchor ears, suspensions, rail cleaners, and other traction and transmission supplies.

MR G. BRAULIK, 8, Lambeth Hill, London, E.C.—Descriptive price list of the "Eclipse" flame arc lamp, illustrating the lamp and a number of accessories for same.

SIEMENS BROS. DYNAMO WORKS CO., LTD., Tyssen Street, Dalston.—In their series of Tantalum lamp "Satisfied Consumer" show-cards, this firm have now included one specially designed to appeal in the French market. Eight-page list showing and stating reduced prices of a number of new patterns of Holophane glassware spheres, hemispheres, concentrating reflector bowls, distributing reflectors, &c., for tantalum lamps. Electrical dealers and contractors who so desire can have a supply of the lists with their own name and address printed thereon for bringing Holophane glassware before electric light consumers, if they send their trade card to the firm.

MESSRS. BERRY, SKINNER & Co., 78, Upper Thames Street, E.C.—Illustrated and priced leaflet relating to their new Berry's patent mica insulated auto-locked D.P. ironclad switch. In outward appearance this switch is exactly similar to the firm's well-known combined switch-fuse, and we understand that their object in putting it on the market is to enable contractors to make a uniform job, where in some cases switches only are required and in others switch-fuses on the same installation. The features claimed for the gear are:—Mica insulation, great mechanical strength, freedom from springs likely to get out of order, rapid make and break. The switch is known as the "Micaloc," signifying that it is mica-insulated and auto-locked.

THE ADNIL ELECTRIC CO., LTD., Artillery Lane, London, E.C.—Two new lists. No. 126 E (12 pages) describes and illustrates, and tabulates data and prices of, a line of small direct-current motors for industrial purposes, which have been designed by the company's principals—the Bergmann Electrical Works. The motors are made in all sizes from $\frac{1}{6}$ H.P. to 6 H.P. The standard machines are of the open type, but they can also be supplied ventilated enclosed and totally enclosed. They can also be supplied as dynamos for either direct lighting or battery-charging apparatus, and for fixing either on a horizontal or vertical surface, or for ceiling suspension. The list also gives particulars of starters and regulators, and prices of motor-generators, flexible couplings, spare parts, &c. A large stock of machines for the usual voltages and standard speeds is held at the above address. Copies of the list will be sent to those interested on application. The other list (No. T 65) deals fully with the "Adnil" electric hooter for mines, tunnels, ships and outdoor use, and with electric horns for motor-cars, fire-alarm and signalling purposes.

MESSRS LAIDLER, RITCHIE & Co., LTD., Longsight, Manchester.—Several small leaflets, one drawing attention to "Fludor" and the "Fludor" soldering lamp. Another particularises and prices the "Meteor" metallic-filament lamp; yet another is devoted to their electric hoist block.

MESSRS. ALLEY & MACLELLAN, LTD., Sentinel Works, Polmadie, Glasgow.—New catalogue (No. 11), containing 48 pages of excellently illustrated matter regarding their "Sentinel" air compressors. A number of pages contain a long list of users of these compressors. Belt-driven, motor-driven, gas engine-driven and portable compressors are all shown and detailed. A number of half-tone views show the latest extensions made to the firm's works.

MESSRS. ISENTHAL & Co., 85, Mortimer Street, Cavendish Square, W.—New list supplementary to No. 16, illustrating and giving tabulated particulars and prices of their Ruhstrat rheostats.

THE BRITISH ELECTRIC PLANT CO, LTD, Alloa.—Two finely produced publications. No. 169 (green cover) contains in 24 pages illustrations and tabulated figures of outputs and speeds of their patent self-balancing centrifugal pumps for high and low lifts; also giving some hints on the installation of electrically-driven turbine pumps, and a table of friction loss in water pipes. No. 142 (red cover) is a second edition of the company's 36-page publication dealing with "Industrial Applications of Electric Motors"; its purpose is to indicate generally the large and varied field of service in which the B.E.P. manufactures find employment. It is capitally illustrated with half-tones, and contains a number of diagrams.

SCHIERSTEINER METALLWERK, Schwerinstr. 3, Berlin w. 57.—Leaflets Nos. 34-37, relating respectively to their automatic switch for lighting alternately two groups of sign lamps; the "Lucifer" automatic time-switch, for stairs, corridors, &c., which extinguishes the lamps connected with it after a period of ½ to 3 minutes,

according to the setting; current limiters, time switches, &c.; and a turnstile.

The American Westinghouse.—The East Pittsburg shops of the Westinghouse Electric and Manufacturing Co. have just begun work upon the heavy order for motors and equipment for the Long Island Railroad Co. This order calls for 130 car equipments, of two 200-H.P. motors each, together with controls, wiring, conduits and air brakes. The total amount of the contract amounts to almost $1,000 000. The apparatus will be delivered early in 1910, in time for the installation of electrical operation on the Long Island system, in connection with the completion of the Pennsylvania tunnels.—*Electrical World.*

Book Notices.—*Schutz der Hochspannungsanlagen.* By Hermann Zipp. Hanover: Dr. Max Jänecke. Price 3M. This is another useful addition to Jänecke's "Bibliothek der Gesamten Technik," as it deals with a subject of great importance at the present time. The problem of the protection of electrical systems against voltage rises, whether due to atmospheric effects or to internal causes, has not yet received the attention it deserves, and a book like the present one, which gives a concise and yet fairly comprehensive account of the whole matter in simple language, and from a non-mathematical point of view, will meet the needs of a large number of readers and may encourage a more systematic and general investigation of the subject. To begin with, the various causes to which voltage rises may be due are discussed, including lightning discharges, stationary or slowly moving static charges, resonance voltage rises, and voltage rises due to switching operations or to accidental short circuits. Some particulars are given of the replies received to a circular on the subject, issued by the "Elektrotechnischer Verein," but the absence of more information as to actual breakdowns which have occurred, and the recurrence of which has been stopped by the adoption of one plan or another, is to be regretted, especially as a good deal of this sort of information already lies scattered through the pages of the technical journals. The second part of the book deals with the question of safety devices to combat the ill-effects of these voltage rises. Under this heading come the question of the earthing of the system, the use of condensers for dissipating high-frequency discharges, spark gaps of the horn type and of the multiple roller type, electrolytic arresters, and one or two other devices. Finally, some particulars of the actual construction of the choking coils, condensers, resistances, &c., used with these devices are given. It will be seen that by keeping strictly to the one subject and assuming that the reader has a general knowledge of the underlying principles, the book, in spite of its small size, covers the ground fairly completely. One or two minor errors may be pointed out for correction in a future edition. On page 28, with a view to emphasising the resonance effect, an impossible and somewhat misleading value of the inductance of an alternator armature has been chosen. On page 39 the explanation given for the voltage rise in a transformer on suddenly switching off the load is unsatisfactory, the action being chiefly due to the leakage flux and not to the main flux. In the numerical example worked on page 55 ordinary logarithms have been used in place of Naperian ones, and on page 140 the suggestion for the use of two protective choking coils in series with overhead lines—one of low inductance to deal with high-frequency discharges, and one of high inductance for low-frequency discharges—is impracticable and unnecessary, as, in any case, the inductance used is limited by the permissible drop in it with the working currents, and a single coil having this inductance gives all the protection available.

Kapazität und Induktivität. By Dr. Ernst Orlich. Brunswick: Fried Vieweg & Son. Price 14 M. ("Elektrotechnik in Einzel-Darstellungen," Vol. 14).—It might at first sight appear doubtful whether a separate volume dealing solely with the question of capacity and inductance is justified, but an inspection of this book shows that its 294 pages are none too many for the detailed discussion of the subject from both the theoretical and practical points of view. Prof. Orlich has been able to draw upon the unrivalled experience of the Reichsanstalt, and the result is a book which contains not only a sound theoretical investigation, but also a mass of practical experimental data which can be fully appreciated even by those not able to profit by the theory. The theory, moreover, is never allowed to stray far from practice, and the author is always careful to explain the physical meaning of the formulæ arrived at and to illustrate the results by applications to important practical problems. The theoretical part occupies about half the book, and deals with such subjects as the effects of a static-electric field as explained by Maxwell's theory, the calculation of capacities, the electric current and the magnetic field it sets up, the Biot Savart law, the definition and calculation of induction coefficients in connection with steady and fluctuating currents, periodic quantities treated by the symbolic method, the effects of capacities and inductances in alternating circuits treated first approximately and then exactly, voltage and current resonance, formation of potential waves in long lines, the influence of skin effect on the coefficient of self-induction, &c. The practical part of the book starts with descriptions of the various available sources of low and high frequency, alternating voltages for test purposes, including stretched wire interrupters, microphone interrupters, high-frequency generators and Duddell arcs. Next, the various instruments suitable for use with fluctuating currents are discussed. These include ballistic galvanometers, electrometers, telephones, and vibration galvanometers. The relative suitability and sensitiveness of these is fully dealt with. The standard capacities, inductances and resistances used for exact tests are then described, and, finally, a large number of selected methods of carrying out absolute and relative capacity and inductance measurements are described in detail, together with their chief sources of error. It is to be regretted, however, that these numerous methods are not more thoroughly compared in a critical spirit, so as to bring out their good and bad points more clearly. As it is, the reader is left in some doubt as to the best method to employ under any given circumstances.

"Journal of the Association of Teachers in Technical Institutions." Vol. II, No. 4. London: St. Bride's Press, Ltd. Price 1s.—This number contains the report of Council and Committees, and various interesting short articles, including Electrical Notes by S. S. Richardson and S. G. Starling. There is also a list of members.

"Electricity and Magnetism." By G. C. Foster and A. W. Porter. Third edition. London: Longmans, Green & Co. 1909. Price 10s. 6d. net.

The Globe Code Co., Ltd., of 18, Eldon Street. E.C., have sent us circulars relating to their "Globe Standard Code," price three guineas, and the "Globe Code Condenser," price one guinea, as well as other publications of the same nature.

"Electric Waves," by W. S. Franklin. New York: The Macmillan Co. London: Macmillan & Co., Ltd. 1909. Price $2 net.

"Journal of the American Society of Mechanical Engineers." December, 1909. Vol. 31, No. 12. Baltimore: The Society.

China.—The following items of news regarding electrical matters in China recently appeared in the *London and China Telegraph*:—

The merchants of Kiangse, China, have subscribed $30,000 gold to establish a telephone service throughout the province, and request the permission of the Governor to do so.

The Chinese Board of Posts and Communications intends to follow the foreign fashion by establishing postal and telegraph offices at all the principal railway stations for the convenience of travellers.

The merchants and gentry of Swatow, China, say that as the business of the port is increasing they do not want to be behind the times, and so have subscribed $200,000 to establish electric trams in the city.

Bankruptcy Proceedings.—Ernest Goodman (trading as E. Goodman & Co.), electrical engineer, 30, Hertford Street, Coventry.—This debtor attended at the County Hall, Coventry, on Monday last for his public examination before Mr. Registrar Kirby. Replying to the Official Receiver, debtor said he added "and Co." to his name just to give a bigger appearance. He had lost a third of the amount of his contracts, competition being so very keen he had to cut things as fine as possible. He had no one to keep but himself. He drew £4 a week out of the business, which, after meeting his expenses, left him 30s. per week for himself. He spent this on clothing expenses and in getting work. Asked if he did not think he had been rather extravagant in his expenses, debtor replied he did not think so. The causes of his failure were bad trade, keen competition and losses on contracts. He first became aware of his position six weeks before filing his petition; he had not said that he knew six months before. What he said was that he knew six months before that he could not pay his debts in full. He borrowed £144 from his home, and spent that in paying his debts, hoping that it would put things right, but it did not do so. The examination was concluded.

Harry Graham, electrician, Albion Street, Huddersfield.—The public examination of this debtor was to have been held last Monday at the County Court House, Queen Street, Huddersfield, before Mr. Registrar Freeman, but the Official Receiver stated that the trustees (Messrs. Netherwood and G. W. Smith) desired to make further investigations into debtor's affairs, and he (the Official Receiver) asked that the case be adjourned. The application was granted.

Robt. Herbert Scotter, civil engineer, late of Southend-on-Sea, but whose present address the petitioning creditor is unable to ascertain. Public examination is announced in the *Gazette* to take place at Carey Street on January 11th.

Dissolutions and Liquidations.—Bradford Electrical Engineering Co., Ltd., 56, Manningham Lane, Bradford.—The solicitor for the liquidators, Mr. W. I. Crabtree, has called a meeting of the creditors of the company for 15th inst., at the Queen's Hotel, Boar Lane, Leeds.

Rossendale Valley Tramways Co., Ltd.—A meeting is to be held at 61, Gracechurch Street, E.C., on January 4th, to hear an account of the winding up.

Mono-Rail Construction Co., Ltd.—This company is winding up voluntarily, with Mr. W. F. Scott Armstrong, 34, Old Broad Street, E.C., as liquidator. A meeting of creditors is to be held on December 20th.

Santoni Arc Lamp and Engineering Co., Ltd.—The accounts just circulated by the joint liquidators show total amounts realised £293 (£118 trading receipts, £33 book debts, and £142 goodwill and stock). The disbursements were: Trading payments £134, legal, liquidation and other charges £75, preferential creditors £27, leaving a dividend of 1s. 10½d. per £ on creditors' claims (£619) £57 = £293.

Glover's Almanac, 1910-11.—The editor of this Almanac is inviting contributions for next year's editions. See our advertisement pages to-day.

Co-operative Societies and Electricity.—A news correspondent learns that various co-operative societies in Manchester and Bolton districts are about to have extensive electrical installations put down in central and branch premises. The contracts will probably be placed early in the new year.

Trade Announcements.—The Electrical Apparatus Co., Ltd., have appointed Messrs. Tetley & Co., of Salford, to be their Manchester and district representatives for E.A.C. motor control gear. The agency does not cover electricity meters.

Messrs. Feld Bros. & Co., Ltd., of London, have appointed Mr. Geo. W. Bunting, consulting electrical engineer, 49, Park Avenue, Whitley Bay, as their sole representative for Newcastle, Middlesbrough and district.

The Ferabin Lamp and Electrical Accessories, Ltd., have recently commenced business at 118, Queen Victoria Street, E.C., for the supply of electrical plant and all kinds of accessories for lighting, bell, telephone and traction installations. In their showrooms they are exhibiting the latest designs of fittings, radiators (glow lamp and convector patterns), and cooking apparatus and large stocks of bell and lighting material are held. The firm's specialities include the Ferabin lamp and dry batteries in various patterns for use in stores, warehouses, &c., for inspection purposes, and by cyclists, motorists, &c., the "Imer" lamp (metallic-filament) for indirect lighting, motors and dynamos, hand-drilling apparatus, &c. Lists are now in the Press.

Messrs. T. H. Brooker & Co., electrical and mechanical engineers, of Gray's Inn Passage, have increased their staff and opened an office at 44, Bedford Row, W.C.

The Electric Construction Co., Ltd., have appointed Messrs. Fyfe, Wilson & Co., 145, Bath Street, Glasgow, to represent them in Scotland, with the exception of collieries. For colliery work they will be represented, as heretofore, by Messrs. Hunter & Jack, 101, St. Vincent Street, Glasgow.

Exhibit.—At the Cattle Show which closes to-day, Messrs. W. H. Wilcox & Co., Ltd., have a stand at which they show a variety of their engineers' stores.

LIGHTING and POWER NOTES.

Acton.—The Electricity Committee has instructed the engineer to prepare a schedule of prices for the wiring of consumers' premises, the proposal being that local electricians who are willing to carry out the work on this scale, be allowed to do so. The present method is to give the contract for free wiring to one firm.

Aberdare.—The District Council's application for sanction to borrow £17,000, in order to lay down an electric generating plant, has been granted by the L.G.B., and it is expected that the work of erecting the new station will be commenced early in the year.

Australia.—Boulder (W.A.).—The T.C. is reported to have resolved to raise a loan of £8,000 for additional plant at the generating station.

According to *Commercial Intelligence*, 20 suburban municipalities in the neighbourhood of Melbourne are promoting a scheme for the erection of municipal electric lighting works. An expert is to be employed in giving a detailed report on the cost of carrying out the work.

Several of the suburban municipalities are negotiating with the Sydney Council with a view to the extension of electricity supply into their areas. When the Sydney Council obtained control of the supply in its municipal area, it was anticipated that it would also supply the surrounding areas, but this has not so far been the case. As a matter of fact, the neighbouring Balmain Municipal Council has handed over to a private company its concession to supply its own citizens and the citizens in surrounding boroughs, and consequently the Balmain E.L and Power Supply Corporation is now competing with the City Council for the custom of the surrounding Councils.

The Sydney Council's engineer has reported on the necessity of holding a stock of metal-filament lamps for street lighting, and recommends that some 3,400 of these lamps be obtained, at an estimated cost of £1,100.

Bexley.—The Council has adopted a revised set of tariffs for electric light and power consumers.

Birkenhead.—The T.C. has decided to light the covered and open markets by means of 30 arc lamps at a cost of £250.

Brazil.—The various concessions granted to the Rio de Janeiro Tramway, Light and Power Co. are understood to have recently been extended as regards electric lighting and gas on satisfactory terms. The company now possesses a virtual monopoly in the Federal District of the tramways, power, electric and gas supplies; it also holds all the share capital of the Rio Telephone Co.

One of our correspondents in Brazil writes:—"It has been reported in several Brazilian papers (dated November 11th and 12th) that the Light and Power Co., of Rio de Janeiro, have intimated to the *Prefeitura* of that city that they intend to raise an action for damages against the authorities for the violation of their concession by the granting of a contract to Messrs. Guinlé & Co. for the supply of electrical energy in Rio. The sum mentioned as indemnity is 10,000 contos of reis, equal to about £600,000. The sum claimed seems enormous, but it is the figure mentioned in three different papers. Whether an extra nought has accidentally slipped in I cannot say."

Camberley.—The Council has decided, by 8 votes to 4, to apply for a prov. order for electric lighting.

Canada.—The Ontario Government's power policy is meeting with a good deal of opposition. Only last week a deputation of prominent citizens from Hamilton, Galt, London, &c., waited on Sir Wilfred Laurier and other members of the Government to urge the disallowance of the hydro-electric power legislation of the Ontario Government. They contended that the legislation was arbitrary, illegal and not in the best interests of the public as a whole. They argued that it was having an injurious effect on the investment of capital from abroad, and that particularly in the case of Galt, which has been compelled to join in the municipal power scheme against its will, it was most unjust. They declared that if the people of Ontario were really aware of the situation the vast majority would demand a repeal of the Act.—Sir Wilfred Laurier, in replying, said there was much force in the arguments presented, and the question of disallowance was now before the Government, which would consider it both from the standpoint of its constitutionality, and with due regard to the expediency of disallowing any provincial Act affecting principally the people of that province. It is extremely doubtful whether Sir Wilfred and his Government will disallow the Act.

A brochure issued by the Department of Mines shows that in the Ottawa and Gatineau valleys there is much undeveloped water-power, and that electrical energy can be produced for $7 per H.P. The water-power at Chat's Falls, 20 miles above Ottawa, can be developed at a cost of $4·50 per H.P. per year, and within a radius of 25 miles from Ottawa 522,325 H.P. can be developed. The report is exceedingly valuable, as these water-powers are destined to exercise a great influence in the development of the country.

Cheltenham.—The T.C. on Monday decided to apply for a loan of £4,000—£2,000 for mains extensions, £1,000 for house services, and £1,000 for meters.

Darwen.—The local Gas and Electricity Committee has decided to supply lighting for outside illuminations in connection with Darwen shopping week, at half the usual cost. The Committee has also decided to decorate a tramcar.

Dover.—The T.C. has received from the L.G.B. sanction to the following loans:—£300 for transformers; £630 for a booster; £600 for chain grate stokers; £3,958 for mains; £1,941 for services; and £990 for excess expenditure on wiring consumers' premises.

Eccles.—The T.C. has decided to apply to the L.G.B. for a loan of £3,234 to cover the amount expended on mains, &c., from March 31st, 1908, to date, and the capital charges in respect of an additional traction set.

Edinburgh.—In the report by Sir A. Kennedy, to the Electric Lighting Committee of the T.C., he estimates that the additional capital expenditure on the Dewar Place and M'Donald Road power stations would amount to £45,000. The new plant would comprise exhaust turbines, condensers, cooling towers, pipework, and would supply at least 3½ million units, generated at a cost of £6,575, or, say, 0·45d. per unit. At present Dewar Place is completely filled with plant, the whole of it being of the non-condensing type, and he considered it impossible to obtain further output without cooling towers. Steel towers cost much less than brick towers, and from prices he had obtained, brick towers would cost for the output suggested about £18,000, while steel towers would cost only about £12,000.

Ellaud.—The U.D.C. has decided to extend the mains to Hullen Edge providing all the owners of houses agree to take a supply of electricity.

Epsom.—Mr. T. F. Squarey has given his award on the question of payment of fees for services rendered by Mr. Vaux-Graham, the consulting electrical engineer. The amount claimed was £385, and the award is that Mr. Vaux-Graham is entitled to the whole of this amount, the fees being reasonable and proper. The arbitrator's fees to be paid by the Council.

Inverkeithing (Fife).—The T.C. is considering a proposal to install an electricity plant for public supply.

Kingsbury.—The chairman of the U.D.C. (Mr. Jose Diaz, J.P.) has been given full power to act on behalf of the Council in regard to the negotiations which are proceeding with the North Metropolitan Electric Power Co., in respect to the electric lighting of the district. In the Kingsbury section of the Edgware Road there are 23 street lamps now lighted by incandescent gas, and these it is proposed shall be converted to electricity.

Leyton.—In regard to the trial public arc lighting, which has been going on for some months in Leytonstone Road, the engineer places the lamps in use in the following order of suitability:—(1) Johnson & Phillips, (2) Jandus, (3) Oliver, (4) Crompton. He accordingly recommends the adoption of the first-named lamp, of which 48 will be required, at a net cost of £10 17s. each. The Council adopted the recommendation of the engineer, subject to inspection and approval of the lamps by the E.L. sub-committee.

London.—Hampstead.—A new sub-station is to be built in Redington Road to cope with the increase in consumption in the West Heath district. Series gears are to be fixed in five sub-sub-stations to increase the transformer capacity, and 95 street gas lamps are to be converted to incandescent electric lamps in the boundary roads between Hampstead and Marylebone and adjacent thoroughfares. It is estimated that 4s. 6d. per lamp per annum will be saved by the conversion.

Bermondsey.—Owing to the growth of the loads on the Spa Road, Grange Road and Tower Bridge Road feeders, it has been decided to lay additional cables to supplement those at present in use.

Shoreditch.—The Lighting Committee has decided to reduce the price for arc lighting outside shops, theatres, churches, &c., and for outside signs, to 2½d. per unit, provided the supply is taken through a separate meter, for which a charge of 1s. per quarter will be made.

Woolwich.—At the last meeting of the Council, it was reported that mains are to be extended to supply a factory in the West Woolwich area. Numerous power users there have been for some considerable time past prepared to favourably consider the adoption of electricity for power purposes. The Woolwich Guardians have accepted the borough engineer's estimate for the installation of electric light at the receiving house and dispensary in Parkdale Road. The necessary extension to the distributing mains will cost about £57.

Milnrow.—The U.D.C. is applying to the B. of T. for a prov. order to enable it to construct two lines of tramways in the town, which will join an intended route from Rochdale.

North Walsham.—The U.D.C. has decided not to apply for a prov. order for E.L.

Port Glasgow.—The T.C. has applied to Greenock Corporation for a supply of electricity, and the Greenock authority is to confer with the neighbouring Council regarding the proposal. Leading shipbuilding firms and manufacturers in Port Glasgow favour the project.

Reigate.—The T.C. has decided to have the mains extended to Cromwell Road Schools at a cost of £42 10s. The Education Committee guarantees a minimum payment of £15 per annum for five years.

Salford.—The T.C. has decided not to raise any objection to the application of the Lancs. Electric Power Co. for a prov. order for E.L. in the urban district of Radcliffe.

South Africa.—The Victoria Falls Power Co., which took over from the Rand Central Electric Co., its station at Brakpan and at Germiston, has had put up alongside the old power station at Brakpan, a new building, constructed of steel and corrugated iron, measuring approximately 114 ft. × 110 ft., and plant has been installed consisting of eight Babcock & Wilcox marine type boilers, in four units, fitted with chain grate stokers, and supplying steam, at 200 lb. pressure, superheated to 575° F., to two 3,000-kw. A.E.G. turbo-alternators which generate three-phase current at 10,600 volts and 50 periods. Condensing water is taken from the Brakpan reservoir alongside the station, and is circulated by means of motor-driven centrifugal pumps, smaller pumps of the same type being also provided for the supply of cooling water through the generator stators and the turbine bearings. Another station recently completed and put into operation at Simmerpan contains similar plant to that installed at Brakpan. The generating capacity, however, is much greater, and there are 16 boilers in two houses and four 3,000-kw. three-phase turbo-alternators. Provision is now being made for the addition of 6,000 kw. of plant. In order to obtain water for condensing purposes for the Simmerpan plant, a canal of about 200 ft. long, 10 ft. wide, and 29 ft. deep from the water level, has been excavated through the rock.—*African World.*

Southgate. — An agreement has been entered into between the North Metropolitan Electric Power Supply Co., Ltd., and the U.D.C., enabling the latter, on giving 12 calendar months' notice, terminating at the expiration of a period of 14 years, or any subsequent period of seven years, to acquire all plant, &c., used by the company upon paying to the company the amount of capital expended by them, and in addition (*a*) if the purchase is at the expiration of a period of 14 years a sum equal to 30 per cent. of the capital expenditure; (*b*) a period of 21 years, 22½ per cent.; (*c*) a period of 28 years, a sum equal to 15 per cent.; (*d*) a period of 35 years, a sum equal 7½ per cent.

Stevenage.—Mr. W. R. Walton, of Manchester, who has been negotiating with Messrs. Crompton & Co. for the transfer of the E.L. order, has informed the U.D.C. that Messrs. Crompton require the payment of £340 in cash or shares, for out-of-pocket expenses, the purchase through them of the necessary plant on a 15 per cent. profit basis, and the payment by Mr. Walton of all the transfer expenses. The Council considers the terms excessive, and has decided to assist Mr. Walton in trying to obtain modified terms.

Torquay.—In connection with the electricity works it is reported that, notwithstanding the large number of lamps connected for private lighting, the demand on the generating station is practically identical with that at the corresponding period of last year, due to the changes made from carbon to metal-filament lamps. The position of the works to deal with the lighting demand is a much better one than last year, as the whole of the alternating-current plant is now available for lighting purposes, whereas last year it was liable to be called upon at any time to supply power for traction. A scheme to extend the main to Chelston, at an estimated cost of £1,312, has been referred to a sub-Committee, and a similar reference was made with regard to the proposed extension of the mains to the higher part of St. Marychurch Road.

Turton.—The U.D.C. has decided to seek expert advice as to the question of putting the new E.L. order into force.

Walsall.—An inquiry was held last week at the Town Hall by Mr. H. R. Hooper, L.G.B., respecting an application by the T.C. for sanction to borrow £35,000 for the purposes of the Corporation's electricity undertaking. The borough engineer (Mr. Barnard) said he was anxious to get the three-phase system alongside the present works, so as to deal with large applications for power. The Inspector pointed out that there was an outstanding debt on the undertaking of £90,000, and they were seeking to secure a further £35,000. He regarded it as a serious thing, that for some years the capital charges had gone up steadily. With their increased output, the capital charges ought to have been reduced. They were faced with a very serious financial difficulty, and should cut their coat according to their cloth. The town clerk pointed out that the £90,000 had been spent in paying their way, and that the ratepayers had not been called upon to pay a single penny. The Inspector next pointed out that last year there was a loss on the undertaking of nearly £900, there was very little reserve fund, and altogether the position was very weak. It was unfortunate for Walsall that it had an obsolete system, but they had no funds whatever to deal with desirable improvements. With regard to the Bloxwich section of the scheme, the Inspector questioned whether the possible increase in consumers would be sufficient to warrant the additional outlay. He suggested that the application might be reduced from £35,000 to £22,000 by leaving out Bloxwich and erecting no new buildings. Mr. Morse (solicitor) opposed the application on behalf of the South Staffordshire Tramway Lessee Co., and submitted that the company for whom he appeared had offered to supply the Corporation more economically than under the proposed scheme, and contended that it would be in the interests of the ratepayers and the Corporation if the offer were accepted. The Inspector will report upon the application in due course.

Wealdstone.—The Board of Trade has revoked the 1906 E.L. order as from December 1st.

York.—The T.C. has applied to the L.G.B. for a loan of £2,475 for electricity purposes, £1,100 being for mains, £800 for motors, and £575 for meters.

TRAMWAY and RAILWAY NOTES.

Accrington.—The borough treasurer has prepared a revenue account of the Corporation tramways for the last half-year. This shows a gross income of £12,708 and a gross expenditure of £11,904, leaving a surplus revenue of £804. This is after making provision for the service and redemption of debt and for the fixed contribution to the depreciation and renewal fund.

Airdrie and Coatbridge.—The local authorities in the towns affected by the operations of the Airdrie and Coatbridge Tramways Co. have received notice of the company's intention to introduce the "fair fare" system at an early date. This system of charging was referred to in our last issue.

Bacup.—Terms have been provisionally agreed upon between Bacup and Rochdale Corporations with regard to the running of cars between the two towns, and in the event of a procedure under the Light Railways Act, 1896, being adopted, an allowance of £126 per annum towards a renewals fund is to be made by the Rochdale Corporation. It has for the present been decided to leave open the question of a supply of electricity, Bacup Corporation undertaking to obtain powers in its provisional order for the Rochdale Corporation to supply electricity in the borough.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, the manager submitted the revenue accounts for the past eight months up to the 30th ult., from which it appeared that the net income was £14,530. The tender of Messrs. Dempster, Moore and W. H. Wilcox, Ltd., for certain supplies, was accepted. At the monthly meeting of the Corporation, on the 2nd inst., it was decided to abolish the centre poles of the tramway system in a certain number of streets.

British Columbia.—The latest extension of the British Columbia Electric Railway will be 64 miles in length. The power to operate the road, comes over H.T. lines at full voltage, and will be reduced to operating voltage by five sub-stations. The machines therein will be 300 to 600-kw. sets. The trains will operate on the multiple unit system. For freight transportation the company has purchased three 50-ton electric locomotives, one of which is in use at present, and has been described in our pages.

Burnley.—The Corporation is going into the question of the revision of the rents of the tramways in Nelson, Brierfield and Reedley Hallows and also the question of the supply of electrical energy in Nelson and Brierfield.

Canada.—The Toronto City Council is considering a plan for a municipal tube system to furnish rapid transit between the heart of the city and the suburbs. The proposal is to build a subway from the Union Station and the St. Lawrence Market up Yonge Street to St. Clair Avenue, with surface lines reaching out to those newly annexed portions of the city, formerly known as Toronto Junction and East Toronto. The tube and surface lines can be built and equipped for less than $5,000,000 (£1,027,397). A referendum on the project will be taken probably in January.—*Standard.*

Continental Notes.—AUSTRIA.—It is considered that the conversion to electric traction of the Vienna City Railway, to which reference was made in this journal a few months ago, cannot be indefinitely postponed, as the working of this steam line already results in an annual deficit, which amounted to £66,000 in 1908, whilst the interest on the capital reaches £291,000 per annum. It is calculated that the work of transformation would involve an expenditure of £2,500,000, and the attention of German firms is being directed to the scheme, as the principal electrical firms in Austria are subsidiaries of the former. The State is financially interested in the railway to the extent of 86 per cent. of the capital; the province of Lower Austria holds 5 per cent. and the municipality of Vienna 9 per cent. It is sought to find a solution of the problem without having to consult Parliament, as Parliamentary conditions are such that a speedy settlement in this way would be out of the question. The idea has, therefore, been conceived that the working of the railway should be entrusted to the municipality, which would have to raise the money for the conversion and equipment. Negotiations on the subject are on the point of being undertaken between the Railway Minister and the Minister of Finance, and these will be followed by deliberations of the Traffic Commission, which at present controls the working of the railway. On their conclusion it will be possible to work out a scheme, and it is possible that the execution of the enterprise will be commenced at the end of 1910.

NORWAY.—The electrification of the Tinnas railway has been decided on, and work in connection with the electrification will be started at once. It is intended to have it completed in the course of next summer, and tenders have been invited for the supply of the materials required. The Rjukan railway is also to be electrified as soon as the work of harnessing the Rjukan waterfalls has been completed.

GERMANY.—Plans are being prepared in respect of a projected electric tramway between Alzenau, Horstein and Weiskirchen, in Bavaria.

Probably as the result of experience gained in Cologne, the German postal authorities have recently placed contracts for the construction of 25 electric motor mail vans for the rapid conveyance of letters between the various post offices in Berlin. In order to save time, a sorter is to be carried on the vans in addition to the driver, so that the letters may be sorted *en route*.

FRANCE.—The new electric tramway along the recently-completed boulevard between Lille, Roubaix and Tourcoing was opened for traffic on the 4th inst.

Glasgow.—A lengthy report has been prepared by Mr. Dalrymple, the general manager, on non-paying car routes on the system. It has been decided, in consequence, to stop two of the routes, and in connection with the other lines, that the service be so arranged that, while giving a reasonable service, the present loss on working will be minimised as far as possible.

In view of the present severe weather, additional covered cars are being hurriedly prepared at the Corporation tramway workshops. It was reported this week that the work of building 100 new double-deckers and putting top covers on another 110 cars was going on. The latter work was nearing completion, but only 50 new cars have so far been built. Instead of proceeding with the construction of other 50 new cars, top covers will be placed on an equal number of single cars.

For the past fortnight Glasgow has seldom been free from fogs, and both the tramway and the electricity departments have been affected. On the former the effect has been most detrimental, the daily drawing dropping by hundreds of pounds, and on Monday of the present week the decrease recorded on fare takings was no less than £400 on the normal. The electricity department has throughout the pressure been able to meet all demands for light and power, reaching a record output of 240,000 units on one day, the normal being 124,000 units.

Halesowen.—At a meeting of the U.D.C. last week, it was stated that Mr. Balfour, the promoter of the light railway scheme, had consented to pay £650 towards the cost of obtaining the provisional order, and that a cheque had been already received for £325.

Inverness.—The T.C. is considering a scheme of tramway haulage in connection with the cleansing department. The cost of ground to be purchased and the necessary equipment is estimated at £6,549.

London.—The Highways Committee of the L.C.C. has recommended an agreement with the Leyton Council, by which the L.C.C. takes over the working of the Lea Bridge Road tramway, some 3 miles in length. The L.C.C. is to construct a junction in Upper Clapton Road, and the local Council is to receive the average receipts for cars on through roads for all mileage outside the boundary, less the L.C.C.'s working expenses, 1d. per car-mile on mileage outside the boundary, and a proportion of capital charges on the Council's car-sheds, &c.

The tramway between North Finchley and Cricklewood Broadway is practically ready for traffic, and will link up the Great North Road and Edgware Road systems, making it possible to travel by car from Barnet to Acton.

New Brunswick.—It is reported that owing to adverse weather conditions, the 12-mile standard gauge electric railway, between St. John and Aroostook Junction, connecting with the C.P. Railway, has been delayed in completion, the bridge building being particularly affected.

Newcastle-on-Tyne.—At a meeting of the City Council on the 1st inst., Mr. J. H. Rodgers, the chairman of the Tramway Committee, in submitting the monthly returns of the tramways said that this year, from April 1st to November 27th—241 days—they had carried 29,408,497 passengers, and they had taken in receipts £134,972. Last year, in the same period, they had carried 20,323,577 passengers, and had taken £135,396, or £424 more than in 1909, and in the latter year they had carried 84,920 more passengers. He pointed out that in the race week of last year and in the week following, when the Royal Agricultural Show was at Newcastle-on-Tyne, they took no less than £11,509, while in the corresponding week of this year they only took £9,598, a decrease of £1,911. Yet that lessening of their income they had reduced to £424, which he thought was most satisfactory. Mr. J. Stephenson moved a resolution from the Newcastle Ratepayers' Association, recommending that a special investigation committee be appointed to go into the question of the management of the tramways. The motion was not seconded, and fell to the ground.

South Lancashire.—Local reports state that tramway traffic in this area was completely disorganised by the heavy snowstorm on December 6th.

Sunderland.—The Corporation Tramways Committee has acceded to the request of the Urban, Rural and Parish Councils in the area served by the Sunderland District Electric Tramways, Ltd., to grant powers to the latter company, so that their cars may run into Sunderland as far as the gas office in Fawcett Street.

U.S.A.—According to the *Electrical World*, a syndicate proposes to build a moving platform system of rapid transit under Broadway, and has had its plans approved by the engineer of the Public Service Commission. Exits would be made at every street crossing, and the estimated cost of construction under Broadway from Tenth Street to Forty-Second Street is 11 million dollars, which will be furnished privately, although the ownership of the line will be vested in the city. The mechanism of this platform will be similar to those at the Chicago World's Fair and the Paris Exposition.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted and Repaired.—Nagara-Kartal cable interrupted December 2nd; restored December 2nd. Nagara-Kartal cable again interrupted December 6th. Cayenne-Salinas and Paramaribo-Cayenne cables restored November 28th. Turk's Island-Jamaica cable restored November 29th. Paramaribo-Cayenne interrupted December 7th.

New Works.—The United Wireless Telegraph Co. of America have decided to put down extensive works in the neighbourhood of Liverpool. This decision has been forced upon the company by the new Patent Act, compelling them to manufacture their patented goods in this country.

St. Vincent.—The revenue of the Telephone Department of the Government of St. Vincent, West Indies, for the last year was £482. The expenditure was £355.

Subfluvial Telephone Cable.—The Postmaster-General has under consideration a proposal to lay a telephone cable under the Tay at Dundee from Stannergate Point to Tayport.

Telegraph Breakdowns.—A violent gale swept over the British Isles on Thursday and Friday last week, causing numerous interruptions to telegraphic communication in many parts of the country.

Telegraph Memorial.—The international competition for designs for a monument to commemorate the formation of the Telegraph Union will be open up to August 14th, 1910. Particulars can be obtained from the Swiss Post and Telegraph Department, Berne.

Wireless Telegraphy.—At the conclusion of Prof. H. Stroud's address to the Newcastle Local Section of the I.E.E. on November 22nd, through the co-operation of Mr. A. Sorensen a demonstration was given showing how the Poulsen waves, being made intermittent at the transmitting station at Cullercoats, actuated an ordinary spark receiver. This demonstration was of interest as showing how stations equipped with the Poulsen arc sender only can communicate not only with Poulsen stations, but also with ships and other stations equipped with the ordinary spark receiver.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—The municipal authorities of Grottau, Bohemia, are about to invite tenders for the establishment of a central electric lighting station in the town.

Australia.—Melbourne.—December 13th. 50,750 incandescent lamps for the City Council. See "Official Notices" November 26th.

Melbourne.—January 5th. One feed-water oil eliminator for the Cit Council. See "Official Notices" November 19th.

Melbourne.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" to-day.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Canterbury.—March 16th, 1910. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Sydney.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" to-day.

Belfast.—January 10th. One 1,500-kw. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" to-day.

Bridlington.—January 1st. 300-kw. steam dynamo for the Corporation. See "Official Notices" to-day.

Cape Town.—January 5th. The Corporation require tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Carlisle.—December 24th. 8,000 yards of wire, and poles for overhead transmission line for the Corporation. See "Official Notices" to-day.

Dundee.—The Water Commisioners invite tenders for the supply of 70 creosoted telephone poles and 2½ cwt. copper wire same as used by National Telephone Co. Geo. Baxter, engineer.

Durham.—December 13th. Stores, including electric fittings, for the Trimdon Grange Colliery Co. (Walter Scott, Ltd.), Durham.

Glasgow.—Electric hoist for northern police office; City Engineer, Municipal Buildings.

Govan.—December 13th. Turbo-alternator, rotary converters, and high-tension switchboard, for the Electricity Committee. See "Official Notices" December 3rd.

Italy.—January 26th. The Italian State Railway authorities in Rome are inviting tenders for the supply of 50,000 metallic-filament electric lamps.

London.—Southwark.—38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" December 3rd.

L.C.C.—December 14th and 15th. Overhead electrical equipment for the construction on the four-wire system of electric traction from Woolwich to Eltham. Electric light and bell wiring and fitting for the Poplar Divisonal offices for the L.C.C. See "Official Notices" December 3rd.

Manchester.—December 13th. Wiring and complete E.L. installation (about 700 lights), at Harpurhey Baths; City Architect, Town Hall, Manchester, (Returnable deposit, £2 2s.)

Spain.—December 15th. Tenders are being invited by the municipal authorities of Ginzo de Lima (Province of Orense) for the concession for the electric lighting of the town during a period of 25 years. Tenders to El Secretario del Ayuntamiento de Ginzo de Lima (Orense), whence particulars can be obtained.

The municipal authorities of San Vicente dels Horts (Province of Barcelona) are inviting tenders for the concession for the electric lighting of the town. Particulars can be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Vicente dels Horts (Barcelona).

Wishaw.—December 13th. 25,000 or 50,000 pairs of carbons for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Canterbury.—The T.C. has accepted the tender of Messrs. E. J. Philpot & Son, for electrical work for six months.

Dublin.—The Corporation has approved the Lighting Committee's acceptance of the tender of the General Electric Co., for 750 meters.

Eastbourne.—The T.C. has accepted the tender of the Aron Electricity Meter Co. for 100 meters.

Glasgow.—The T.C. Committee has recommended the acceptance of the following tenders:—

Trolley poles.—Estler Bros.
Single-core lead-covered cable.—British Insulated and Helsby Cables, Ltd.
Polished brass tubes.—P. & W. MacLellan.
Steel gongs.—Charles M'Neil.

London.—L.C.C.—The Stores Committee has recommended the acceptance of tenders from the following:—

Electric carbons.—Wm. Geipel & Co.
Electric fittings.—Elliott Bros.; Falk, Stadelmann & Co., Ltd.; Wm. McGeoch & Co., Ltd., and A. Round.
Electric insulating materials.—British Insulated and Helsby Cables, Ltd.; British Westinghouse Electric Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.; Jas. North Hardy and Son; India-Rubber Gutta-Percha and Telegraph Works Co., Ltd.; J. G. Ingram & Son; D. Jaroslaw; Micanite and Insulators Co., Ltd.; Ruberoid Co., Ltd.; G. Schultz & Co.; Whitely Bros.; F. Wiggins & Sons.
Electric cables and wires.—Hooper's Telegraph and India-Rubber Works; Yorkshire Cable Co., Ltd.

The Highways Committee received the following tenders for the covering with asbestos tape of various high and low-tension cables used in connection with the Council's tramways:—

Johnson & Phillips, Ltd. (accepted)	£1,242
Western Electric Co.	1,521
Siemens Bros. & Co., Ltd.	1,818
Callender's Cable & Construction Co., Ltd.	1,978
Vauxhall Engineering Co.	2,097
British Insulated and Helsby Cables, Ltd.	2,465
R. W. Blackwell & Co., Ltd.	2,510
W. T. Henley's Telegraph Works Co., Ltd.	2,787

Southwark.—The B.C. has accepted the tender of the Aron Electricity Meter Co., Ltd., for two 400-ampere meters and two 25-ampere meters.

Minehead.—A contract has been placed with Messrs. E. S. Hindley & Sons by the Minehead Electric Supply Co., Ltd. for one of their vertical multi-cylinder gas engines to be directly coupled to a 134 kw. dynamo.

Reading.—The T.C. has provisionally accepted the tender of Messrs. W. Cory & Sons, Ltd., for 160 tons of steam coal, at 9s. 3d. per ton for the tramway depôt.

Russia.—The city of St. Petersburg having recently transformed its tramway network for electric working, has placed with Messrs. Brown, Boveri & Co., of Baden (Switzerland), the order for a 5,000-kw. turbo-alternator with a surface-condenser. The new machine is capable of supplying the whole system.

Sheffield.—The T.C. has accepted the tender of the British Electric Transformer Co. for eight sets of transformers and switchgear (each set consisting of one 200-kw. main transformer, one 20-kw. auxiliary transformer and one set of two-wire series control gear), £222 each; also two 200-kw. transformers, £151 each.

Sheerness.—The U.D.C. has accepted the tender of the Sheerness Electrical Power Co., for electrically-driven pumping machinery at the Sewage Works, at £397.

Woolwich.—The B.C. has accepted the following tenders in connection with a supply to a factory in the West Woolwich area:—

Siemens Bros. & Co., Ltd.—Cable, £2,984.
Albion Clay Co.—Ducts, £765.

FORTHCOMING EVENTS.

Northampton Polytechnic Institute. St. John Street, Clerkenwell.—Friday December 10th and Saturday, December 11th. From 6.30 to 11 p.m. Distribution of prizes, &c., by Sir John Wolfe Barry, and students' conversazione.

Association of Engineers-in-Charge.—Saturday, December 11th. At 1.30 p.m. Visit to the Woolwich works of Messrs. Siemens Bros. & Co., Ltd.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 11th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Electric Shot-Firing," by Mr. J. Douglas, and other papers.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 13th. At 8 p.m. Paper on "Planning and Equipment of Turbo-Generating Stations," by Mr. T. Walmsley.

Institution of Electrical Engineers (Newcastle Section).—Monday, December 13th. At 8 p.m. At the Armstrong College, Newcastle. Paper on "The Use of the Flicker Photometer for Differently Coloured Lights," by Mr. H. M. Airey.

Wednesday, December 15th. Annual dinner.

Physical Society.—Tuesday, December 14th. From 3 to 6, and 7 to 10 p.m. Annual exhibition.

Institution of Civil Engineers.—Tuesday, December 14th. At 8 p.m. Paper on "Railway Signalling in India," by Mr. C. W. Hodson.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, December 14th. Meeting at 8 p.m. At 207, Bath Street, Glasgow.

Institution of Electrical Engineers (Manchester Section).—Tuesday, December 14th. At 7.30 p.m. At the University, Manchester. Paper on "Notes on Methods and Practice in the German Electrical Industry," by Messrs. L. J. Lepine and A. R. Stelling.

Institution of Electrical Engineers (Leeds Section).—Wednesday, December 15th. At 7.15 p.m. At the University, Leeds. Paper on "Metallic-Filament Lamps: Their Possible Beneficial Effects on Supply Undertakings," by Messrs. G. Wilkinson and R. McCourt.

Institution of Electrical Engineers (Students' Section).—Wednesday, December 15th. At 7.45 p.m. At 92, Victoria Street, S.W. Paper on "Electricity Supply on Tap," by Messrs. C. B. Nadaud and W. B. Thompson.

Institution of Electrical Engineers (London).—Thursday, December 16th. At 8 p.m. At the Institution of Civil Engineers. Papers on "Some Quantitative Measurements in connection with Radiotelegraphy," by Dr. J. S. Fleming; and "Efficiency of Short Spark Methods of Generating Electrical Oscillations," by Dr. W. H. Eccles and Mr. A. J. Makower.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, December 13th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, December 14th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, December 15th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, December 16th.—"C" Company. Technical drill, 7 to 9.30 p.m.

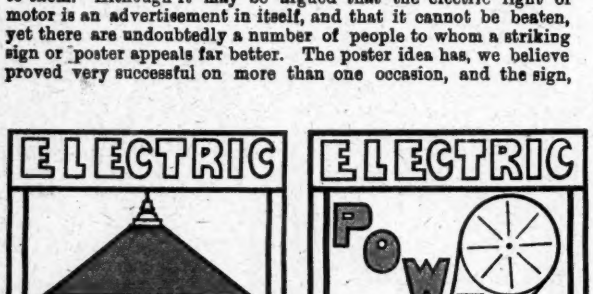
Friday, December 17th.—"D" Company. Technical drill, 7 to 9.30 p.m.

Saturday, December 18th.—Corps Dinner held at the Monico, Piccadilly Circus, at 7.30 for 8 p.m.

(Signed) P. H. CAMPBELL Capt. R.E. and Adjutant,
For O.C. E E., L.D.

NOTES.

Advertising the Supply.—It is, or should be, a maxim of the present-day central station engineer that his wares, in the form of light and power, shall not go a-begging merely because possible consumers have not had their attention sufficiently drawn to them. Although it may be argued that the electric light or motor is an advertisement in itself, and that it cannot be beaten, yet there are undoubtedly a number of people to whom a striking sign or poster appeals far better. The poster idea has, we believe proved very successful on more than one occasion, and the sign,



which is of a more permanent nature, is being taken up by several electric supply undertakings. Through the courtesy of Mr. W. A. Vignoles, borough electrical engineer of Grimsby, we are enabled to reproduce a couple of enamelled iron signs for lighting and power respectively, which he has recently designed and is introducing in Grimsby. The power sign would be fixed to works where motors were in use, and the lighting sign to lamp-posts—the latter sign being swung from a bracket and backed by a design for power similar to the one used for fixing to works, but with the wording slightly altered to suit. We congratulate Mr. Vignoles on his enterprise, and would suggest that other engineers may find it worth while to take up this matter of street signs.

Siemens Bros.' Dinner.—The dinner of the Apparatus Department of Messrs. Siemens Bros. Co. was held on Saturday, December 4th, at the Assembly Rooms, Old Charlton. This department of the works may be said to be a lineal descendant of the early telegraphic and cable work in which the firm of Siemens Bros. were pioneers. The chair was taken at 6.30 p.m. by Mr. F. Hird, the manager of the department, who was supported by Mr. Grimston, Mr. Perry, Dr. Wright, Mr. Forrest, Mr. Rieber, and others, and there were several guests from the Royal Arsenal and the Admiralty. The foremen and staff present numbered about 180. After the customary loyal toasts, the programme of the evening resolved itself into an entertainment of music and song, in which Messrs. Brown and Brenton distinguished themselves in their patter song and dance; and Miss Smith, Miss Turner, Miss Quilter and Miss Gladys Peters were evident favourites.

The firm has long been distinguished as one in which the relations of all from the top to the latest office-boy have been consistently peaceful, and there was a reasonable sprinkling of grey beards or white heads, to demonstrate the appreciation by the firm of the steadying effect of years, and of the fact that dividends need not be accompanied by inhumanity—that, in fact, the conditions and management of the business are such that it is not necessary to "scrap" older and experienced men in order to live up to the firm's rule of never allowing a customer to go away dissatisfied. To a strict adherence to this rule the success of the firm has very greatly to be attributed, as well as to the realisation of what responsibility means on the part of each workman; for, needless to say, in these days of mechanical exactitude every man must constitute himself a part of a human system of limit gauges, and act within the proper limits. Here, as well remarked by one speaker, comes the value of a foreman who knows the limits of his men, and, avoiding slackness on the one hand and fussiness on the other, gets out of each man his best.

Electrical Driving of Textile Factories.—After our "Correspondence" columns were closed, the following came to hand:—"Referring to the letter on the above subject which appeared in your issue of the 3rd inst., the Council of the Bradford Engineering Society, after full inquiry, desires to confirm the report as a true and accurate record of the proceedings of the Committee.

"The complete report was typed and issued to every member of the Committee several weeks before the meeting at which it was finally adopted, and no portion was, therefore, published without the knowledge of every member, and without full opportunity for discussion.

"The Committee decided from the outset not to enter into any discussion undertaken for the purpose of personal or trade advertisement, and it would obviously be useless to take notice of any further communication from gentlemen who so lightly repudiate the statements for which they themselves are responsible.

"GEORGE CARTER,
"*Secretary, Bradford Engineering Society.*

"Bradford, *December 7th* 1909."

Electricity and Publicity in London.—The Associated Municipal Electrical Engineers of London have now placed before the various borough councils owning electricity undertakings the full details of their scheme with regard to publicity matters. "Their subject," they say, "is one which is largely non-controversial, and the best results can only be obtained on systematic and co-operative lines, and in pursuance of this view, a committee of municipal and company undertakings have met together, and have fully considered the matter, and particularly its financial aspects, and they are of opinion that the establishment of such an organisation would result in material benefits to all concerned, with a maximum of efficiency and a minimum of expenditure. It is proposed that the municipal and company undertakings should appoint a joint committee for the purpose of joint action in this matter, consisting of 14 members, seven being selected from the chief officials of the municipal undertakings, and seven from the chief officials of the London companies, and it is suggested that the title of the committee be 'The Electric Supply Publicity Committee of London and District.' The committee would hold regular meetings for discussing and arranging the duties to be undertaken, which may be briefly summarised under the following heads:—(*a*) Organisation and administration of publicity matters generally; (*b*) the preparation, printing and publication of publicity productions of common interest; (*c*) control of any funds coming into the hands of the committee; (*d*) submission of annual report and audited statement of accounts to the subscribers. For the present it is intended that the work of the committee should be mainly directed to the preparation and printing of pamphlets and circulars to be supplied to members of the organisation. It would not, however, be of any advantage to set up such an organisation unless the Committee were assured of having a certain amount of support. It is, therefore, proposed that for the first year orders for publishing work to the value of about £1,000 should be guaranteed by the various undertakings, and in order that the Committee may have funds to commence operations, it is suggested that each company joining the organisation shall, in the first instance, subscribe on the following basis: Gross revenue of undertakings from private supply. Not exceeding £10,000, minimum annual contribution to the organisation, £10; exceeding £10,000, and not exceeding £20,000, £20; exceeding £20,000, and not exceeding £30,000, £30; exceeding £30,000, and not exceeding £40,000, £40; exceeding £40,000, and not exceeding £75,000, £50; exceeding £75,000, £60. Each local authority joining the organisation shall guarantee minimum orders for publicity literature on the same basis. As a general indication of the work of the Committee, and of the methods of ensuring effective publicity, which would, of course, be varied from time to time as circumstances may require, the methods of publicity will consist of: (1) Publicity of leaflets, cards, posters, &c.; (2) Regular issue of short leaflets; (3) Preparation of pamphlets on power, light, new methods of electric lighting, residential lighting, shop lighting, heating and cooking, types of heaters, cooking apparatus, economy in use, &c. It is fully expected, says the Association, that the production of pamphlets on a large scale will so reduce the cost, that undertakings will thus obtain very much more advertising matter than is possible by any other means. If any production be found to be particularly effective by any undertaking, that undertaking will be able to obtain such quantity as it may desire, even if the minimum sum be thereby exceeded."

Electric Turpentine.—In an American Consular report, it is stated that a company in British Columbia is working an electric process for the distillation of turpentine from mill refuse, tree stumps, &c. Six or eight gallons are obtained from a cord of wood, and the product is said to be chemically pure. The cost of erecting a mill is estimated at $1,500 "per cord to be treated." The by-products find a ready sale.

Institution and Lecture Notes.—Faraday Society.—At the annual general meeting on November 30th, the following officers and Council were elected to serve for the Session 1909-10:—

President—J. Swinburne, F.R.S.

Vice-Presidents.—G. T. Beilby, F.R.S.; Sir R. A. Hadfield, F.R.S.; Prof. A. K. Huntington; Dr. Ludwig Mond, F.R.S.; Lord Rayleigh, O.M., F.R.S.; Prof. A. Schuster, F.R.S.; Ernest Solvay.

Treasurer.—Dr. F. Mollwo Perkin.

Council.—E. J. Bevan, Bertram Blount, A. C. Claudet, W. R. Cooper, S. Z. de Ferranti, F. W. Harbord, W. Murray Morrison, H. K. Picard, J. L. F. Vogel, and N. T. M. Willsmore.

Junior Institution of Engineers.—In the course of his inaugural address on November 16th, the president (Engineer Vice-Admiral H. J. Oram, Engineer-in-Chief of the Fleet) referred to the various proposals to utilise electricity in the propulsion of ships. He questioned whether the economical results obtained on shore could be achieved on board ship, and argued that, in the case of certain cruisers, there would be no appreciable gain in fuel consumption at full power—though there would be a gain at low powers, and increased power for going astern. The efficiency of the high-speed propeller could probably be increased, and the use of larger slow-running propellers would in some cases be impossible owing to the design of the hull. The engine-room weights, he thought, would be increased by 15 to 20 per cent. Admiral Oram also objected to the high voltage required, and pointed out that the three electrical speeds provided for were not sufficient to enable ships to keep station. While thus adversely criticising the various schemes put forward, he said that future developments would receive careful consideration, and that the good work done by electrical engineers on board warships was too well known to need any comment.

A party of members of this Institution recently paid a visit of inspection, under the guidance of the resident engineer, Mr. E. H. Tabor, M.Inst.C.E., to the Embankment Wall Works for the New County Hall, Belvedere Road.

Royal Institution.—The following are among the lecture arrangements at this Institution, before Easter: Mr. W. Duddell, a Christmas course of six illustrated lectures on "Modern Electricity," adapted to a juvenile auditory: (1) First Principles; (2) Electrical Instruments; (3) Röntgen Rays; (4) The Generation of Electricity; (5) Electric Oscillations; (6) Electric Lighting. Prof. S. P. Thompson, three lectures on "Illumination, Natural and Artificial." Prof. Sir J. J. Thomson, Professor of Natural Philosophy, R.I., six lectures on "Electric Waves and the Electromagnetic Theory of Light." The Friday evening meetings will commence on January 21st, when Prof. Sir James Dewar will deliver a discourse on "Light Reactions at Low Temperatures." Succeeding discourses will probably be given by Mr. C. E. S. Phillips, Lord Rayleigh, Dr. Charles Chree, Prof. Sir J. J. Thomson, and other gentlemen.

Institution of Electrical Engineers (Dublin Section).—The Section was to meet yesterday to hear a paper on "The Tierney-Malone Electric Point Shifter," by Mr. J. P. Tierney, member.

The Catford Electric Home.—With reference to the Model Electric Home, of which we gave particulars last week, we learn from the South Metropolitan Electric Light and Power Co., Ltd., that the interest shown by the public has altogether exceeded expectations. The fact that this demonstration of what can be accomplished by the aid of electricity is not on the old lines of a "Model Show House," but is a "Home in full swing," seemed to have great weight with the hundreds of people who, during the short time which has elapsed since its opening, have paid visits from far and near. The example of the company is one that we hope will be copied in many parts of London and the provinces.

Westminster Electric Swimming Club.—The fourth Annual Dinner of the above Club was held at Victoria Mansions Restaurant, Victoria Street, S.W., on Monday, December 6th, about 80 members being present. Mr. Hordern (manager) was in the chair, and Mr. F. Iago (secretary) in the vice-chair, supported by the chiefs of the various departments. The dinner was voted a great success, and was followed by a concert which proved most enjoyable. The vice-chairman, in proposing the toast of "The Club," referred to the excellent progress made during the current season, which had been a record one in every way. He was very glad to see the successes which had been gained in the life-saving classes. Mr. A. Collingwood (hon. secretary) replied briefly. The prizes were presented by Mr. Hordern. Later in the evening Mr. Bennett, in proposing the health of the chairman, referred to the excellent feeling which existed between the management of the company and the employés. The toast was received with musical honours.

"At Home."—Aberdeen Corporation electricity department held its annual "At Home" on Thursday last week, under the auspices of the Sports and Works Club. Mr. Bell, as honorary president of the Club, presided.

A Disastrous Gasometer Explosion.—One of the most deplorable accidents of its kind occurred on December 7th at the Hamburg Gasworks, when a newly-built 7,000,000 cb. ft. gasometer in some way developed a huge leakage which was ignited by some neighbouring retorts. The resulting flames involved a second gasometer of 200,000 cb. ft. capacity. Both gasometers and the buildings near by were destroyed, and unfortunately 20 persons were killed and 25 injured.

Institution of Electrical Engineers' Dinner.—The annual dinner of the Institution took place on Wednesday evening at the Hotel Cecil; Dr. Kapp presided, and there were about 290 present—the smallest number for some years. After the loyal toasts, Sir W. H. White proposed "The Institution of Electrical Engineers," remarking that the Institution, while one of the youngest, was one of the most remarkable and useful of its kind, and was exceeded in numbers only by the Civil Engineers. Engineering was like a noble tree, rooted in science, and with constantly ramifying branches bearing good fruit; collaboration between all the branches was essential to progress. The I.E.E. had found a home worthy of itself, and no society more cordially rejoiced in its progress than the Institution of Civil Engineers. Dr. Kapp responded, expressing sincere appreciation of the goodwill of the Institution of Civil Engineers as personified in Sir W. H. White. Electrical engineering, he said, was a willing servant to other professions, and brought them prosperity. There were few English industries that lacked prosperity. We were passing through a temporary phase of depression—but England used to be at the top, and would be there again. In former times electrical engineers had little use for science; foreign firms had found it necessary to cultivate science in order to compete with us, and even went too far in that direction. Electricity with them was a bounteous lady—with us she was but a homely body. But some of our leaders of industry had recognised the virtues of electricity. Oxford, like Cambridge, had instituted a Chair of Engineering, and he welcomed this recognition of engineering as a noble profession. The old universities would thus teach the future leaders of industry the importance of applied science, and the newer technical universities would supply the trained lieutenants. His predecessor had pointed out that we sold more energy, at lower rates, than the Germans, but, it was said, this was generated in foreign machines. However, the amount of foreign plant installed was only 8 per cent.! There was no monopoly, and we had a fair share of the honours. Direct driving and the proper use of storage were originated in England. The first electric railway was built in Ireland, by an English firm. Multipolar dynamos and three-phase machinery came from abroad; they were now best made by us. The Continent led the way in three-phase and single-phase railway working. The turbo-generator was developed by the Hon. C. A. Parsons, and our rivals had not caught us up yet. In power transmission we were a little ahead. At Kinlochleven, for instance, 30,000 H.P. was utilised, the plant being of British make throughout. Waste gases were utilised at the Bilston works for driving the works and rolling mills, the plant, of British make, being absolutely equal to anything on the Continent. Mr. Merz had led the way in the North-east, and the consumer paid less for energy here than anywhere else in the world. Lastly, electricity could help agriculture; Sir O. Lodge's researches had enabled this to be done. About 12 farms were equipped, the result being an average increase of 30 per cent. in the crops produced.

Prof. S. P. Thompson (in lieu of Lord Justice Fletcher Moulton) proposed "Science and Industries," eulogising Sir Joseph Larmor, who had done so much to elucidate the nature of ether and matter, and Mr. J. A. F. Aspinall, who had laid down the first heavy electric railway in England. Sir Joseph Larmor, in responding, said that Faraday was one of the greatest mathematicians that ever lived, though neither he nor his contemporaries were aware of it. It was the function of science to lead the way to the Promised Land, and of engineering to take possession of it. He expressed the indebtedness of the scientific world to the Institution for the publication of *Science Abstracts*—the acknowledged standard compendium of physical science. Mr. Aspinall, also responding, praised the work of the technical colleges, declaring that our youths were as well trained to-day as those of any other country. We ought to train more commercial engineers, properly equipped for work in foreign countries and our Colonies. The countries which we had opened up were markets for British goods, but we were losing the trade for lack of trained commercial men. Liverpool University had done the right thing in starting a Faculty of Commerce. The mechanical engineer of the future would not be considered of any great value unless he had a fair knowledge of electricity.

Sir J. Gavey proposed "Our Guests," offering them a hearty welcome, and Col. Sir Charles B. Euan-Smith responded in a humorous speech.

The company then adjourned to the Victoria Hall, where conversation continued to a late hour. A programme of music was performed by the Imperial Orchestra, and the arrangements were, as usual, irreproachable.

Greater London Electrical Engineers.—A special meeting of the representatives of the Associated Municipal Electrical Engineers (Greater London), and the London Companies Officials' Association, was held at the Hammersmith electricity works on December 2nd, when papers were read by Mr. A. H. Seabrook on "The Telephone System of Charging"; and by Mr. Bell on "Electric Heating," with special application to the Therol heater. The meeting was largely attended by both the municipal and the company representatives, and an interesting discussion took place. It is hoped that future meetings of a similar nature will be arranged.

Inquiries.—We are asked for the name of a firm who contract for vulcanite sheeting moulded *in situ* on electrical machinery. A borough electrical engineer wishes to know where combined plant for lighting and traction has been installed, consisting of two dynamos coupled to one engine. (Blackpool, Portsmouth and Bexley occur to us in this connection.) The addresses of agents in England of makers of the Girod, Giffre or Keller electric furnaces are asked for.

L.C.C. Appointment.—A year ago an assistant was temporarily engaged for electrical work in the chief engineers' department of the L.C.C. in connection with the education service. It is proposed to continue the appointment until December 3rd, 1910, at 52s. 6d.

Appointments Vacant.—Assistant teacher in engineering drawing, for Faraday House (£120); assistant engineer for Dudley electricity works; senior general clerk (£130), also a correspondence clerk (£90), for Hackney Electricity Department. See our advertisement pages.

Wiring System.—Shares Offered.—We have received a prospectus of the M.P. Electrical Co., Ltd., from Mr. Sarsfield W. Martyn, of 11, Pratt Street, N.W.; 10,000 preference shares (10 per cent.) of £1 each are being offered. The objects of the company are to sell, and deal in, all kinds of electrical apparatus, but more particularly in a new system of wiring invented by Mr. Martyn, and to be known as the M.P. wiring system. The total nominal capital is £31,000. Only the preference shares are now offered for subscription. The inventor is to take £250 cash, 15,000 £1 ordinary shares, and 20,000 deferred shares of 2s. each. The remaining 5,000 ordinary shares it is intended to issue later. After the ordinary and preference have received 10 per cent. dividend, the deferred share the balance equally with the ordinary. Any of our readers who may be interested in the matter, should refer to our editorial opinion of the system as expressed on page 216 of the ELECTRICAL REVIEW, August 6th, 1909, and to the prospectus itself, a copy of which can be obtained from Mr. Martyn.

Physical Society's Annual Exhibition. — This exhibition, which is to be held on Tuesday, the 14th inst., will differ from that of previous years in that it will be open both in the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.) Short discourses will be delivered at 4 and 8 p.m. by Prof. C. V. Boys, F.R.S., on "Soap Bubbles," and at 9 p.m. by Prof. S. P. Thompson, F.R.S., on "Combinations of Mica and Selenite Crystals."

Smelting Iron Ore.—The Swedish Ironworks Society, says *Affärsvärlden*, has approved an agreement with the Elektrometal Co., Ltd., for the use of patent rights, and has authorised the expenditure of 250,000 kr. on the construction of an electric furnace at Trollhättan. A company is also being formed at Hardanger, in Norway, by the Norsk Elektrometal Co., Ltd., with a capital of one million kr., to construct furnaces employing 4,400 H.P.

Lectures.—At King's College (University of London) a special course of lectures, with demonstrations, by Prof. E. Wilson and Mr. F. Lydall, on "Single-Phase Electrical Traction," will be delivered on Mondays, commencing January 17th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The West Bromwich T.C. has adopted the recommendation, mentioned in the ELECTRICAL REVIEW last week, to increase the salary of MR. W. A. JACKSON, electrical engineer, from £300 to £350 a year.

At the Derby T.C. meeting on Wednesday, last week, after a long discussion, it was resolved to increase the salary of MR. E. G. BOISSIER, mains superintendent, from £156 to £170 per annum, with further increases of £15 per annum to £200 per annum.

The staff of the Urban Electric Supply Co. at Carne Brea has presented a dressing case to MR. WOOLCOCK, who is leaving for South America.

Sheffield T.C. has been recommended to increase the salary of MR. H. E. YEBBURY, the chief electrical engineer of the tramways, from £450 to £500 per annum.

General.—MR. D. R. MAYHEW has resigned his position as branch manager to Messrs. Willans & Robinson, Ltd., in order to take up the position of general manager to Messrs. Michael Pal and Co., engineers, Westminster.

Obituary.—The numerous friends in this country of MR. T. COMMERFORD MARTIN, of New York, will learn with very deep regret that Mrs. Martin died on November 28th. Mrs. Martin, *née* Elizabeth Gould, was a native of Gravesend, Kent. Mr. Martin, it will be remembered, retired from the editorship of the *Electrical World* a short time ago in order to throw his entire energies into the work of the National Electric Light Association, of New York, as its secretary. The editors of the ELECTRICAL REVIEW desire to tender their sincere sympathies to their friend in his hour of bereavement, and they are sure that many others in the electrical world on this side will wish to do likewise.

NEW COMPANIES REGISTERED.

New Motive Power, Ltd. (106,124).—This company was registered on November 25th, with a capital of £20,000 in £1 shares, to construct, manage or control in England, railways, tramways, trolley ways, mills, factories, pumping or other works, to be manufacturers of and dealers in cycles, flying machines and other vehicles, electricians, electrical and general engineers, &c. The subscribers (with one share each) are:—W. L. Smith, 11, Tothill Street, Westminster, S.W., engineer; H. Gilbert, 43, Finsbury Square, E.C., architect and surveyor. Private company. The number of directors is not to be less than five: the first are S. Constanduros, W. G. Coxen, F. G. Rice, J. V. Sherrin and W. L. Smith. Holders of shares Nos. 1 to 10,000 may nominate another director, and such holders shall be entitled to one vote for each share held by them; remuneration according to profits. Company's borrowing powers unrestricted. Registered by H. W. Clarkson, 85, Gresham Street, E.C.

F. Burks & Co, Ltd. (106,099).—This company was registered on November 24th, with a capital of £10,000 in £1 shares, to acquire the business carried on at 87, Port Street, Manchester, and elsewhere, by F. Burks & Co., and to carry on the business of electricians, electrical engineers, manufacturers of electrical instruments, machines, telephones and other apparatus and devices, &c. The subscribers (with one share each) are:—F. Burks, Capstone, Mellor, Stockport, electrical engineer; F. C. Poulton, 7, Highfield Drive, Monton, Manchester, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are F. Burks and F. C. Poulton, managing directors, and V. Bramall, C. Stephenson and T. L. Miller; qualification, 250 shares; remuneration of managing directors, £5 each per week and 1 per cent. per annum of the net profits; of ordinary directors, £150 per annum, divisible. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Thomas Foreign Patents, Ltd. (106,196).—This company was registered on November 30th, with a capital of £500 in £1 shares, to acquire from J. G. P. Thomas the benefit of certain patents relating to an invention in connection with an electro-mechanical power transmission system, to develop and turn to account the same, and to carry on the business of manufacturers of and dealers in motor cars, cabs and other vehicles, carriages, electrical machines, accumulators, internal combustion engines, electrical, mechanical and general engineers, &c. The subscribers (with one share each) are:—K. J. Thomas, 21, Ennismore Avenue, Chiswick, W., engineer; J. G. P. Thomas, Holywell Vicarage, North Wales, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. J. Thomson, J. G. P. Thomas and K. J. Thomson. Registered by Jordan and Sons, Ltd., 116-117, Chancery Lane, W.C.

Peninsula Engineering Co. Ltd., (106,206).—This company was registered on December 1st, with a capital of £5,000 in £10 shares (380 preference), to take over the business of electrical and general engineers, contractors and agents, carried on in Spain and Portugal by Hastings, Roberts and Co. The subscribers (with five shares each) are:—P. W. McDougall, 39, Norbury Crescent, Melfort Road, Norbury, electrical engineer; A. M. Billington, Suffolk House, Laurence Pountney Hill, E.C., civil and electrical engineer. Private company. The first directors are A. M. Billington, P. W. McDougall and H. Hastings; the two last named are managing directors; qualification, £100. Registered office, Suffolk House, Laurence Pountney Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Tungsten Lamp Co., Ltd. (100,468).—A memorandum of satisfaction to the extent of £200 on September 15th, 1909, of debentures dated May 18th, 1909, securing £4,000, has been filed.

Romapac Tramway Construction Co., Ltd. (75,242).—Particulars of £1,600 debentures created October 18th, 1909, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

Nairobi Electric Power and Lighting Co., Ltd. (87,738). Particulars of £5,000 third debentures created November 25th, 1908, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,000 (ranking *pari passu* with two former series securing £6,000 and £4,000 respectively). Property charged: The company's undertaking and property, present and future, including uncalled capital; but excluding £1,500 deposited or to be deposited in the joint names of the Crown Agents for the Colonies and National Bank of India, Ltd., uncalled capital on 10,000 preference and 6,000 ordinary shares and contract dated July 26th, 1906. No trustees.

Consolidated Signal Co., Ltd. (71,141). (Formerly Pneumatic, Electric & General Engineering Co., Ltd.)—This company's annual return was filed on November 17th, when 214,195 preference and 150,548 ordinary shares had been taken up out of a nominal capital of £445,000 in 220,000 preference and 205,000 ordinary shares of £1 each. £1 per share has been called up on 27,849 ordinary and 24,999 preference, and £52,839 has been paid. £311,934 is considered as paid on 189,196 preference and 122,708 ordinary. Mortgages and charges: Nil.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

MR. J. B. BRAITHWAITE, chairman, presided on Monday at the offices, Finsbury Pavement House, E.C., over the fifth annual general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, December 3rd, page 907), said the board had again to congratulate the shareholders on the extremely satisfactory year's progress. Last year he pointed out the satisfactory progress which had been made, but this year he was happy to say the progress was fully as satisfactory, and perhaps a little more so. The charges in the balance-sheet simply showed the issue of the additional capital which had been found necessary for the carrying on of the business. The whole of the £150,000 preference stock had now been issued, and the whole of it had been taken up in the

Colony itself, which was a very satisfactory feature. Since the close of the financial year on August 31st, he might also say they had placed the whole of the balance of the ordinary stock in Adelaide at par. Including this last issue, there was now about £130,000 capital of the company held locally, which was very satisfactory for two reasons. Firstly, it showed the confidence of local investors in the company; and secondly, it was always an advantage to have shareholders on the spot. On the credit side of the balance-sheet, the expenditure on the undertaking showed an increase of approximately £40,000, and that represented their capital expenditure during the year. The cash at the bankers and in hand was £4,645. The debtors showed an increase, which was due to the larger business they were doing, and were £6,407, as against £3,804. Last year they reduced the suspense account to £2,500, and they proposed to write it off entirely in this year's accounts out of profits. Their main interest would, of course, be in regard to the revenue account, and there they would be distinctly gratified. In the figures he proposed to deal with he would take no account of the supply of current to the Municipal Tramways Trust, because that was only a temporary thing, and was not an element of a permanent character. If he were to include these figures it would give an entirely misleading idea of the actual position. Their receipts from private consumers had increased from £19,150 to £24,091, an increase of £4,941, which was fully as great an increase as took place in the previous year. The receipts for power were £8,618 compared with £6,814, an increase of £1,804. Therefore, from these two sources they had nearly £7,000 increase in earnings. What had it cost to earn this additional money? The generation of electricity cost £10,126, against £8,571; distribution cost £2,346, against £1,903; and repairs and renewals cost £2,878, against £2,132. The result was that the £7,000 additional revenue had been earned at an increased expenditure of something under £3,000, but they had also to bear in mind that in this increased expenditure they had also supplied all the units for the Municipal Tramways Trust, so that their technical staff had to be heartily congratulated on the increased efficiency they had brought about at the generating station. In the general charges there had been an increase of £281, and the total result was that they had to carry £25,226 to the profit and loss account, which was an increase of £11,563 on the previous year. They had carefully considered what they should do with the balance, and it was a little difficult to decide, in view of the temporary character of the supply to the Tramways Trust. That supply was due to cease in September, 1910, and then there must necessarily be a certain interval whilst they were loading up the plant, which would then be set free, with their own customers. They had carefully considered what rate of dividend they could rightly declare which they could see their way to maintain, and had decided after the payment of the preference dividend to recommend the declaration of a dividend of 6 per cent. on the ordinary shares for the year, which would compare with 3½ per cent. last year; to extinguish the suspense account; to place £1,000 to reserve, bringing that account up to £4,000; and to set £5,000 to an equalisation of dividend account. This £5,000 could be used for the equalisation of dividend if necessary, although he did not think it would be necessary. Having made these allocations, they would carry £1,009 forward. He thought they would agree that this was a prudent and business-like course to adopt. With regard to the growth of the business, and again excluding the units sold to the Municipal Tramways Trust, the figures showed that they had 91,338 8-C.P. lamps for lighting against 71,138, or an increase of 20,200. The motors totalled 2,369 H.P., against 1,837 H.P., an increase of 532 H.P. The total connections, lighting and power combined, expressed in 8-C.P. lamps were 167,146, against 129,922, an increase of 37,244; and the units sold were 2,073,550, against 1,666,974, an increase of 406,576; which was almost exactly 20 per cent. They had added in the year 13 miles of mains, and had 2,314 consumers, which was an increase of 37 per cent. on the year. During the year they had authorised an extension of their mains to Glenelg, which was the Brighton of Adelaide, and no doubt they would pick up a certain amount of lighting on the way. The supply was now available along 93 miles of streets.

Mr. R. P. Sellon seconded the motion, and the report was adopted without discussion.

Mr. Braithwaite having been re-elected to the board, and the auditors having been re-appointed,

The Chairman proposed that the best thanks of the shareholders be accorded to the local board and also the technical officers, Messrs. F. W. Clements, Weeden and Inglis, and their subordinates, for their successful efforts in carrying out the company's undertaking.

This was seconded by Mr. A. F. Farish, and carried unanimously.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The directors' report for the year ending September 30th, 1909, to be presented at the meeting to be held on Tuesday next, states that after provision for doubtful debts there is a net profit of £57,927. Adding £51,980 brought forward, and deducting £12,500, the dividend on the ordinary shares paid in June, and £3,333, the dividend on the preference shares paid in July, there remains a disposable balance of £94,074, which, after providing for the balance of the dividends for the year, will leave £55,012 to be carried forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders on January 1st, and they further recommend the distribution of a dividend to the holders of ordinary shares of 15s. per share, free of income-tax, amounting to £37,500, making, with the interim dividend paid in June, a total payment of 10 per cent. for the year. The general business of the company shows an increase compared with the turnover of last year, which is, however, partly due to the higher scale of prices at which some of the company's goods have been sold. Taken as a whole, the company's foreign agencies have not done so well as the board had reason to expect, but the sales of their home agencies have been fairly satisfactory. The prices of some raw materials have attained a very high level, but the advances the company has been able to make in the selling prices of its goods have sufficiently met the case; some provision, furthermore, has been made to cover a possible fall in selling price of stocks in hand. The board is making a considerable capital expenditure at the French works to meet the expanding motor and bicycle tire trade on the Continent, and further capital expenditure will, doubtless, be necessary at home. These latter extensions are having the serious consideration of the directors, as a growing business must have facilities provided. The electrical industry continues dull. A certain amount of cable work has fallen to the company's share, and its steamers *Dacia* and *Buccaneer* have had occasional employment. The works at Silvertown and Persan have been maintained in the usual state of efficiency. The board appointed Mr. Matthew Hamilton Gray, Mr. Christian Hamilton Gray and Mr. William Ernest Gray extraordinary directors, as they have been closely identified with the management of the business for several years, and have largely contributed to its success. Mr. Matthew Gray expressed his regret that he was unable to give the close attention he would like, but hoped the board would accept his service in a consulting capacity, and to this the board agreed.

Bullers, Ltd.—The report for the year ended July 31st, 1909, as quoted in the financial Press, states that the depression in trade, mentioned in the last annual report, has continued with even greater severity, and sales have been largely reduced, both in volume and profit. The accounts, after paying directors' fees and managing directors' salaries, show a profit of £3,932, which, with £906 brought forward, makes a total of £4,839. The sum of £5,000 has been transferred from reserve account, making a total of £9,839. Interest on the preference shares, £7,500, and a dividend of 1¼ per cent. on the ordinary shares, £1,875, have been paid, leaving a balance of £464, which the directors propose to carry forward.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter to September 30th of 2s. 6d. per share, free of income-tax.

Globe Telegraph and Trust Co., Ltd.—The directors have declared an interim quarterly dividend of 3s. per share on the preference stock and 2s. per share on the ordinary shares.

Prospectuses.—*Molesworth Bros.' Rubber Estates, Ltd.*—There have been offered for subscription this week 580,000 shares of 2s. each at par. The company acquires the Molesworth Bros.' Estates, situated in Trincomali, Ceylon, 2,800 acres.

London Sumatra Rubber and Produce Estates, Ltd.—An issue at par of 50,000 shares of £1 each has been offered. The company acquires the Serapoh, Tanah-Abang and Permatang-Djiring Estates, Sumatra (7,533 acres, of which 1,538 acres are under cultivation).

Sedenak Rubber Estates, Ltd.—30,000 shares of £1 each have been offered for subscription at par. The company acquires the Sedenak Estate from the Malaya General Co., Ltd., and will develop and extend same.

T. Sugden, Ltd.—We are informed that the directors have declared a dividend of 15 per cent. per annum on the ordinary shares, payable on December 7th, 1909.

Electromobile Co., Ltd.—The directors' report states that the accounts for the year to August 31st show that the debit to profit and loss of £2,744 brought forward, has been increased to £6,511.

New York Edison Co.—According to the report for the year 1908 filed with the Public Service Commission, which has just been made public, the New York Edison Co. had a corporate surplus on December 31st of $14,835,546. Assets on the balance-sheet showed a grand total of $131,764,516. The total funded debt is $44,062,395. Figures bearing on operation show that during the year the company delivered 252,416,153 KW.-hours of energy, for which it received $15,228,716. The company at the end of the year had 73,522 consumers, an increase during the year of 8,284, of which increase 7,163 were in Manhattan and 1,121 were in the Bronx. The company had 90,283 meters in service, and a connected load at a 16-C.P. equivalent of 6,729,926. There were 41,822 arc lamps and 3,429,266 incandescent lamps in service. The report of the Long Acre Electric Light and Power Co. for the same period showed assets of $564,955, of which $566,313 was the estimated value of the franchise. The gross operating revenue was $3,804, and the total operating deficit was $20,586. The company had 10 consumers and 11 meters in Manhattan.—*Electrical World and Engineer.*

Bank Rate.—The Bank Rate was yesterday reduced to 4½ per cent.

MARKET QUOTATIONS.

Wednesday, December 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	£1 dec.
a Copper Sulphate	„	£18 10	..
a Lead, Nitrate	„	£27 10	£1 inc.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	3½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£75	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c „ Tube (brazed)	„	9d.	..
c „ „ (solid drawn) ..	„	7¾d.	¾d. dec.
c „ Wire, basis	„	6¾d.	..
c Copper Tubes (brazed)	„	9d.	..
c „ „ (solid drawn ..	„	9d.	..
g „ Bars (best selected) ..	per ton	£72	£2 dec.
g „ Sheet	„	£72	£2 dec.
g „ Rod	„	£73	£2 dec.
e „ (Electrolytic) Bars ..	„	£61	£1 15 dec.
e „ „ Sheets ..	„	£77	£2 5 dec.
e „ „ Rod ..	„	£65 10	£2 5 dec.
e „ „ H.C. Wire	per lb.	7¾d.	¼d. dec.
f Ebonite Rod	„	3/8	..
f „ Sheet	„	3/-	..
g German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 6/6	..
h India-rubber, Para fine	„	7/5	9½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	50/6½	5½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 5	dec.
m Manganin Wire No. 28	per lb.	6/6	..
Mercury	per bot.	£9 16	1/6 dec.
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	..	..
p „ „ rolled bars & rods	„	..	..
p „ „ rolled strip & sheet	„	..	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	9d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£142 10 to £143.10	£5 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	¼d. inc.
p White Anti-friction Metals:—			
"White Ant" brand	per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n F. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List—

Charing Cross, West End and City Electricity Supply Co.—Further issue of £182,570 4½ per cent. debenture stock.

Western Telegraph Co., Ltd.—The directors have declared the first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1910, being at the rate of 6 per cent. per annum. The transfer books will be closed from December 13th to 18th.

North Metropolitan Electric Power Supply Co.—At an extraordinary general meeting held at Kingsway on December 3rd, Mr. Garcke presiding, the directors were authorised to issue debentures not exceeding £25,000.

Electrical Securities, Ltd.—A financial daily says that, after providing for debenture interest, the accounts for the year ended November 14th show a loss of £5,442, increasing the debit balance brought down to £10,486.

STOCKS AND SHARES.

Tuesday Afternoon.

More hopes of a reduction in the Bank Rate led up to substantial improvement in Consols and kindred securities. Although this hope, and the price of Consols, became damped, the Home Railway market for once in a way responded to the earlier lead, and a truly remarkable set of rises in this department is the feature of the week.

Precisely why the revival in Home Rails should have come at this particular time it would be very difficult to explain. Certainly the traffics of the chief companies are showing improvement, and equally certainly the Home Railway market has gone for a long time without so much as a spasm of strength. A retail demand for stock has found the market ill-supplied, and it needed but a small amount of buying to energise prices into a miniature boom.

Of the Undergrounds, Metropolitan Consolidated has the most gain to its credit, but Metropolitan District stock is 1¼ up, and City and South London Ordinary rose a point. So far the Central London issues have not moved. One of the steam stocks to appreciate most has been Brighton Deferred, although the first week of the working of the newly-electrified portion was by some pessimists considered unsatisfactory.

In the advance a fair number of prior-charge issues have also shared, so that altogether it may be said that the Home Railway market presents an appearance of general strength as welcome as it is unwonted.

While the railway companies' stocks have been going ahead like this, the tramway and omnibus division has been anything but happy. London United Tramways Preference shares are ⅛ lower, and the Debenture stock a point. The London General Omnibus Company, with which, of course, the Road Car and the Vanguard are now amalgamated, has published accounts, for the first period under the triple working arrangement, which can only be described as deplorable. British Electric Traction Preference are ⅛ better, on the proposal to establish farthing fares.

Amongst the colonial and foreign traction descriptions, British Columbia Deferred and Preferred are lower, the former by 2½ points, but the 5 per cent. Preference stock has improved. Rio Trams drooped to 93½. San Paulos are steady at 153½, and Mexico Trams are 1 lower. Mexican Light and Power Common and Preference stocks have declined rather sharply.

Smithfield Markets Ordinary again make the best showing in the supply list, the price having shot up about 11s. 3d. to $2_{1\,6}$, which is nearly four times the price at which they stood less than a month ago. The rise is still associated with the extension of the company's lease; the matter was mentioned here last week. Brompton Ordinary and Preference have improved. Charing Cross Ordinary and City of London Ordinary are better, from which it might almost be fair to assume that the advent of radiators is already benefiting the companies.

The Drapers' Company is adding a new storey to one of the houses which it owns in Throgmorton Street, and, in consequence of necessary chimney-work, all the offices in the building will have to cease firing for a time. In its place, temporary electric radiators are being installed, and some, no doubt, will remain as permanent institutions.

Telegraph stocks and shares are unassumingly quiet. The Anglo-American Deferred speculative counter is jumping about to some extent, although on balance the net change is small. Amazon shares are ⅛ lower; West India and Panama have lost half that fraction. Commercial Cable Debenture stock continues to shrink. Eastern Telegraph Ordinary, on the other hand, displays another advance, and Globe Telegraph and Trust Ordinary are ⅛ better. Great Northerns have moved up again.

National Telephone Preferred declined slightly, and American Telephone Capital stock went back 1½ points. United River Plate Telephone shares have firmed up, and Mackay Companies' Common shares regained their decline of last week.

Castner-Kellner shares have rallied again, but otherwise the changes in miscellaneous shares are hardly worth notice. Rubber shares suffered a sharp check last week on a fall in the price of the raw material at the auction sales. There was, however, a subsequent recovery which wiped out a good deal of the previous fall.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. is payable on January 1st.

France.—The balance-sheet of the Compagnie Générale d'Electricité, of Paris, shows a net profit of £95,365, out of which a dividend of 6 per cent. is being declared.

SHARE LIST OF ELECTRICAL COMPANIES

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	Closing Quotations Nov. 30th.	Closing Quotations Dec. 7th.	Business done week ended Dec. 7th, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent.
											£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	3/16 — 4	3/16 — 3/8	..	..	— 1/16	Nil.
135,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	5 %	5 %	5 %	99 — 102	100 — 103	..	..	- 1	4 17 1
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½ %	8 %	8 %	145 — 147	143 — 146	145	..	— ½	5 9 7
$58,000,000	Do. Collat. Trust, 4 % Bonds, 1 to 29,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
552,460	Anglo-American Telegraph	Stock	3¼ %	3¾ %	3¼ %	£3 4s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	100 —101	100 —101	101	100	..	5 18 10
3,220,770	Do. do. do. Deferred	Stock	1½ %	1¾ %	1 %	8/-	21½ — 22½	21⅞ — 22½	22	21½	..	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 6
2,451,350	Commercial Cable, Sing. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	86½ — 88½	88	87	— ½	4 10 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅜ — 9⅛	8⅜ — 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	10	10 %	10 %	10 %	10 %	8 — 8½	8 — 8½	..	..	..	6 5 0
50,000	Do. do. 4½ % Debs.	20	4½ %	4½ %	4½ %	4½ %	100½ —102½	100½ —102½	..	..	..	2 3 11
60,710	Direct United States Cable	20	4½ %	4½ %	4½ %	4½ %	13 — 13½	13 — 13½	13⅝	..	..	6 4 7
43,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —132	131 - 134	133⅜	130½	+ 2	5 4 6
2,000,000	Do. 5½ % Pref. Stock..	100	5½ %	5½ %	5½ %	5½ %	84½ — 86½	84½ — 86½	86	84⅜	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103	102½	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11⅜ — 12½	11⅜ — 12½	12⅛	11⅛	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	102	..	..	3 16 11
200,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½ %	5½ %	5⅞ %	5⅞ %	10½ — 10⅞	10½ — 10⅞	10⅞	10⅝	+ ⅛	5 7 0
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13½ — 14	13⅝ — 13¾	13¾	13⅝	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	20 %	18 %	29½ — 30½	30 — 31	..	..	+ ½	5 16 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	12 %	12 %	12 %	51 — 53	51 — 53	51	..	..	7 1 2
$41,880,400	Mackay Companies Common	$100	2 %	3½ %	4 %	93 — 95	96 — 98	..	..	..	4 1 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	77 — 79	77 — 79	..	..	..	5 1 3
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	⅜ — ⅝	⅜ — ⅝	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	⅜ — ⅝	⅜ — ⅝	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	107 — 108½	106½ —108	107½	106⅝	— ⅛	5 11 1
3,795,000	Do. do. Def. Stock	100	5 %	5 %	6 %	120½ —122½	120½ —122½	121⅛	121	..	5 2 1
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	10½ — 11	10½ — 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	10⅛ — 10⅝	10⅛ — 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½ %	3½ %	3½ %	98 —100	98 — 100	..	..	..	3 10 0
1,968,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	100 —102	100 —102	101⅛	100⅞	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	5 5 9
60,000	Do. do. do. 6 % Cum. Pref....	1	6 %	6 %	6 %	1⅝ — 1¾	1⅝ — 1¾	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	87½ — 89½	87½ — 89½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	100 —102	100 — 102	..	..	..	3 18 6
11,899‡	Reuter's	8	5 %	5 %	5 %	⅞ — 8⅛	⅞ - 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½ %	4½ %	4½ %	101 —103	101 — 103	102½	..	..	4 7 10
8,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	129 —132	129 — 32	131½	..	..	4 7 5
190,000	United River Plate Telephone	5	8 %	8 %	8 %	6⅞ — 7⅛	7 — 7⅛	7⅛	7⅛	+ 1/16	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5⅛ — 5⅛	5⅛ — 5⅛	..	..	+ 1/16	4 6 11
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½ %	2½ %	1⅜ — 1⅝	1⅜ - 1⅝	32/6	31/3	..	3 16 4
160,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	12⅜ - 13¼	12⅜ - 13⅝	12¾	13⅛	..	5 0 11
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	— 1/16	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	8⅞ - 9⅛	8⅞ - 9⅛	9	8⅞	+ 1/16	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	8 — 9	8 — 9	..	..	..	13 13 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4 7/16— 4 11/16	4 7/16— 4 11/16	91/10½	90/-	..	5 2 4
800,000	Do. 5 % 2nd Pref., 800,001 to 1,800,000	5	..	..	..	..	4½ — 4¾	4½ — 4¾	87/6	..	..	5 11 1
978,280	Do. 4 % Deb. Stock	..	..	..	..	4 %	90½—92	90½ — 92	91½	91½	..	4 7 5
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅜ — 4⅝	4⅜ — 4⅝	93/9	92/6	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1½ — 1¾	1½ — 1¾	..	..	..	37 6 8
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅛ — 2¼	2⅛ — 2¼	..	..	..	15 1 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¾ — 3¼	2¾ — 3¼	..	..	..	6 14 8
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½ %	5½ %	5½ %	99 — 99	96 — 99	..	..	..	5 14 7
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	8 %	8 %	143 —148	14⁴ —145	..	..	—2½	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	121 —125	120 —124	123	..	—1	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	106 —109	107 —110	108½	..	..	4 11 9
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½ %	4½ %	4½ %	4½ %	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½ %	4½ %	4½ %	4½ %	102½ -104½	103 —106	104½	..	..	4 6 2
188,801	British Electric Traction	10	3 %	Nil	Nil	Nil	⅜ — 1	7/8 - 1	16/3	13/9	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	1½%	2¾ - 2¾	2⅞ - 3	58/9	54/6	+ ⅛	5 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 - 87	85½	..	..	5 14 11
598,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	60 — 65	60 — 65	64½	63½	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	7 — 7⅛	7⅛	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6½ - 6¾	6⅝ — 6¾	6¾	..	..	4 11 8
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½ %	4½ %	4½ %	4½ %	103 —106	103 —106	104	..	..	4 4 11
304,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½ %	4½ %	4½ %	4½ %	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅞ — 1	⅞ — 1	..	..	..	Nil
1,616,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 13 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	7/16— 9/16	7/16— 9/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	41 — 46	41 — 46	..	..	..	9 15 8
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½ %	4½ %	4½ %	4½ %	27 — 31	27 — 31	..	..	..	14 10 2
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	6 %	4½ %	4½ - 5	4½ — 5	97/6	92/6	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½ %	4½ %	4½ %	4½ %	101 —104	101 —104	..	..	..	4 6 7
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10¾	10 — 10¾	10	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 8 11
900,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	7/16— 9/16	7/16— 9/16	4/6	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2⅛ — 2⅜	2⅛ — 2⅜	45/6	44/-	+ 1/16	5 12 3
710,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½ %	4½ %	4½ %	4 %	106 —109	106 - 109	107⅝	..	..	3 13 5
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	61 — 63	61 — 63	61½	..	..	5 3 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 - 46	..	..	..	5 8 8
1,490,000	City and South London Railway	Stock	1½ %	3½ %	3½ %	1½%	29½ — 30½	30½ - 31½	31	30	+1	4 15 2
85,000	Crompton & Co., Nos. 1 to 85,000	5	3½%	5 %	5 %	5 %	⅜ - ½	⅜ - ½	..	..	..	15 1 8
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid. † A period of nine months. From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906	1907.	1908.	Closing Quotations Nov. 30th.	Closing Quotations Dec. 7th.	Business done week ended Dec. 7th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
980,000	Dick, Kerr & Co., 1 to 980,000	1	10 %	10 %	10 %	10 %	1 — 1⅛	1 — 1⅛	..	..	..	8 17 9
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
771,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	2½%	1½%	⅝ — ¾	⅝ — ¾	..	..	— 1/16	34 18 0
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	2½%	2½%	1 — 1⅛	1 — 1⅛	18/9	..	..	8 6 8
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 12 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	1	Nil	Nil	Nil	Nil	1/16 — 1/16	1/16 — 1/16	7/-	6/9	— 1/16	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	1	7 %	7 %	7 %	7 %	1⅛ — 1⅛	1⅛ — 1⅛	26/3	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do. 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	⅝%	Nil	¾ — 1	..	..	..	..	6 13 4
98,000	Greenwood & Bailey, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10⅝	10¼ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12⅜	12 — 12⅜	12⅜	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
60,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	10 %	15⅜ — 16⅛	15⅜ — 16⅛	16⅛	..	..	6 1 3
97,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅜	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
899,980	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜%	2⅜ — 2⅝	2⅜ — 2⅝	..	..	— ⅛	13 12 8
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	63 — 66	62 — 65	63½	62⅝	—1	6 3 1
5,782,062	Metropolitan Consolidated	100	2⅜%	1 ⅜%	⅜%	3⅜%	36½ — 37	38⅜ — 39½	39½	38⅜	+2⅛	1 5 5
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	2⅜%	64 — 66	65 — 67	..	..	+1	4 2 1
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	16 — 16½	17⅛ — 17⅞	17⅞	16	+1⅛	Nil
891,387	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅛ — ⅛	⅛ — ⅛	..	..	..	6 10 11
814,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/16 — 1/16	1/16 — 1/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/16	1/16 — 1/16	..	..	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	125 —127	124 —126	126	125½	—1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	92	91½	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	1/16 — 1/16	1/16 — 1/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/16	1/16 — 1/16	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34½ — 36	35	34½	..	5 0 0
140,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	5 %	100 —101	100 —101	100	..	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	86 — 88	87⅝	..	..	5 2 3
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	31 — 33	30 — 32	..	..	—1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	¼ — ½	¼ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	1	Nil	..	6 %	6 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77 xd	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	+ ⅛	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 15 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	6⅝ — 7⅜	7 — 7⅜	..	..	+ ⅛	6 13 4
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅝ — 7⅜	7 — 7⅜	..	..	+ ⅛	4 13 4
$ 18,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 99	97 —100	..	..	..	4 0 10
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅝ — 4⅛	3⅝ — 4⅛	..	..	+ ⅛	5 17 8
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 5 11
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	5 16 2
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,596	10	6 %	6 %	6 %	6 %	9⅞ — 10⅜	10⅛ — 10⅜	10⅜	10 5/16	+ ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102⅜	100⅝	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1⅞ — 2	1⅞ — 2	..	..	..	5 0 0
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅛ — 2⅜	2⅛ — 2⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	95⅛ — 95¾	95⅜ — 95⅝	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ — 8	7⅛ — 8	7⅞	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	10⅞	..	..	5 7 10
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	— ⅛	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1stMtg. Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	6¾%	6¾%	6⅞ — 7¼	6⅞ — 7¼	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	101 —103	101 —103	..	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	7 3/32	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 17 1
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	9⅛	..	..	4 4 8
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6¾%	5 %	3⅞ — 4⅛	3⅞ — 4⅛	77/6	..	..	5 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	9o/-	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	107	106	..	4 2 7
948,000‡	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	83½ — 86½	83½ — 86½	85½	84½	..	4 0 11
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	80½ — 82½	81 — 83	82⅜	..	+ ⅛	6 0 6
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	5%	71½ — 73½	69 — 71	7 1/2	70	—2½	4 18 7
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	102 —106	101 —105	..	..	—1	6 13 4
$13,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	84 — 86	85 — 87	8 1/2	85	+1	5 14 11
£50,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	8 %	2½%	4 — 4½	4 — 4½	..	..	..	2 15 1
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 10 2
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	98 —100	98 —100	..	..	..	..
10,863	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12⅛ — 13⅛	12⅛ — 13⅛	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
60,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 18 6
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	23/3	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8½ — 9	8½ — 9	..	..	..	6 7 0
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
160,000‡	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1⅜ — 1⅝	1 13/16 — 2 5/16	39/4½	31/3	+ 5/16	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	5/16 — 5/16	5/16 — 5/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 17 11
294,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	⅜ — ⅝	⅜ — ⅝	17/6	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	18 %	12 %	10 %	10 %	8⅝ — 8¾	8⅝ — 8¾	8⅝	8½	..	5 12 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5½	5 — 5½	5⅛	5 1/16	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. ‡ Interim Dividend.

ELECTRIC TRAMWAY COSTING AND STATISTICS.

[COMMUNICATED.]

Tramway Costing may be said to belong to that category or group of accounts whose technical appellation is Operating Costs. Costing is a generic term, and is usually preceded by a qualification according to the description of undertaking to which it is applied. Systems of Operating Costs are simple in construction, whilst the collation of the necessary material, its classification, and the mode of its presentation, are in practice free from difficulty.

All Operating Costs possess a standard or unit of measure into which they are converted. The recognised unit of cost in an electric tramway undertaking is the car-mile, in terms of which all revenue income and expenditure for uniform periods are calculated and expressed.

Schedule 1.

STORES RECEIVED BOOK.

Date received.	Stores Ledger folio.	Supplier.	Description.	No. or weight.	Price.	Amount.	Total.

Schedule 2.

STORES ISSUED BOOK.

Date supplied.	Requisition.	Stores Ledger folio.	Description.	No. or weight.	Price.	Amount.	Total.	Allocations.			

Schedule 3.

STORES LEDGER.

..... (Description of stores.)

Received.								Issued.							
Date.	Stores Received Book folio.	Supplier.	Description.	No. or weight.	Price.	Amount.	Total.	Date.	Requisition.	Stores Issued Book folio.	Description.	No. or weight.	Price.	Amount.	Total.

Schedule 4.

STORES REQUISITION.

No. .....

..... Department. ..... Date.

To the Storekeeper.

Please supply the following materials.

..... (Signature.)

Description.	No. or weight.	Allocation.	Columns for use of Storekeeper.			
			No. or weight supplied.	Price.	Amount.	Folio of Stores Issued Book.

Schedule 5.

STATEMENT OF GOODS TAKEN INTO STORES.

For the ending ....19 .

Date.	Supplier.	Particulars.	Amount.	Total.	Remarks.

Schedule 6.

STORES STATEMENT.

For the ended.....19 .

Stores received.		Stores issued.		Allocation of issues.				
				Operation.				
Date.	Amount.	Date.	Amount.	Oil, grease, tallow, &c.	Water.	Light.	Sundries.	Total.
Stock on hand brought forward from immediately preceding period.								
Stores taken into stock during the period, as per statement attached.		Stock on hand.						
Total								

ALLOCATION OF STORES (*continued*).

Generation.							
		Repairs and maintenance of					
Fuel.	Water, oil, waste and engine-room stores.	Power house buildings.	Engines and boilers.	Dynamos, exciters, &c.	Other machinery & instruments.	Accumulators, &c.	Total.

ALLOCATION OF STORES (*continued*).

Distribution.					Buildings.	Permanent way.		
	Repairs and maintenance of—						Repairs and maintenance.	
Inspection.	Cables.	Overhead equipment.	Section boxes.	Sub-stations and plant.	Total.	Repairs and maintenance of offices, car sheds, stores and other buildings, excluding power house buildings.	Inspection.	Ordinary maintenance	Renewals.	Total.

ALLOCATION OF STORES (*continued*).

Cars and car equipments.								Capital. (As per details attached.)	Aggregate.
	Repairs and maintenance.								
Inspection.	Car bodies.	Motors and controllers.	Trucks and gear.	Axles and wheels.	Trolley poles and wheels	Lighting equipments	Total.		

Schedule 7.

Wages Pay Bill and allocation for the week ended..... 19

No.	Name.	Grade.	Time.	Rate.	Amount.	Allocation.				
						Operation.				
						Clerks and storekeepers.	Traffic and other inspectors	Drivers and conductors.	Pointsmen, car and track cleaners, and sundry labour.	Total.

ALLOCATION (*continued*).

Generation.						Distribution.					
	Repairs and maintenance of						Repairs and maintenance of				
Generation.	Power house buildings.	Engines and boilers.	Dynamos, exciters, transformers, &c.	Other machinery and instruments.	Accumulators.	Total.	Inspection.	Cables.	Overhead equipment.	Section boxes.	Sub-stations and plant.	Total.

ALLOCATION (*continued*).

Buildings.	Perm. way.			Cars and car equipments.											
	Repairs and maintenance.				Repairs and maintenance										
Repairs and maintenance of offices, car sheds, stores and other buildings, excluding power-house buildings.	Ordinary maintenance.	Renewals.	Total	Inspection.	Car bodies.	Motors and controllers.	Trucks and gear.	Axles and wheels.	Trolley poles and wheels.	Lighting equipments.	Total.	Capital (as per details attached).	Aggregate.

Schedule 8.

Salaries Pay Bill for the ended ..... 19 .

No.	Name.	Grade.	Rate.	Amount.	Allocation.						
					Capital, as per allocation at foot.	Generation.	Distribution.	Operation.	Cars and car equipments.	Buildings.	Permanent way.

Schedule 9.

Comparative Summary of Income and Expenditure for ended.....19 .

INCOME.

Route.	For corresponding period of ended.....				For ended				Increase.				Decrease.			
	Receipts.	No. of cars.	Car-miles.	No. of passengers.	Receipts.	No. of cars.	Car-miles.	No. of passengers.	Receipts.	No. of cars.	Car-miles.	No. of passengers.	Receipts.	No. of cars.	Car-miles.	No. of passengers.
Traffic Receipts																
Sundry Receipts																
Total for 28 days																
Brought forward from immediately preceding period.																
Total to date																
Balance at date																

EXPENDITURE.

Description.	For corresponding period of ended.....		For ended.....		Increase.		Decrease.	
	Amount.	Per car-mile.	Amount.	Per car-mile.	Amount.	Per car-mile.	Amount.	Per car-mile.
Operation ..								
Generation ..								
Distribution								
Buildings ..								
Perm. way ..								
Cars and car equipment								
Administration and general								
Total for 28 days								
Brought forward from immediately preceding period.								
Total to date								
Balance at date								

Schedule 9.

Cost Statement and Statistics for ended.....19 .

Description.	Amount.	Total.	Per car-mile. This year.	Per car-mile. Last year.
(a) Operation—				
Inspectors' wages				
Clerks and storekeepers' wages				
Drivers and conductors' wages ..				
Point boys, car and track cleaners, and other wages				
Salaries				
Stores				
Water				
Light				
Sundries				
Total				
(b) Generation—				
Wages				
Salaries				
Fuel				
Oil, waste, water and engine room stores				
Repairs and maintenance—				
Power station buildings wages.....				
stores				
Engines and boilers wages.....				
stores.....				
Dynamos, transformers, motors, &c. wages.....				
stores.....				
Other machinery, instruments, &c. wages.....				
stores.....				
Accumulators wages.....				
stores.....				
Sundries				
Total				
or				
(c) Purchase of Energy— (Particulars.)				
Total				
Forward				

Schedule 9.

Description.	Amount.	Total.	Per car-mile. This year.	Per car-mile. Last year.
Forward				
Distribution—				
Wages				
Salaries				
Stores				
Repairs and maintenance—				
Sub-stations and plant wages.....				
stores				
Overhead equipment wages.....				
stores.....				
Cables and section boxes wages.....				
stores.....				
Sundries				
Total				
Buildings (excluding Power Station)—				
Wages				
Salaries				
Stores				
Total				
Permanent Way—				
Salaries				
Ordinary maintenance wages.....				
stores.....				
Renewals wages				
stores.....				
Total				
Forward				

Revenue income, it may be stated here, is income, the equivalent of which is not payable by the undertaking, and revenue expenditure as distinguished from that of capital is expenditure from which the equivalent is not receivable by the undertaking.

Stores, Wages and Indirect Charges may be said to embrace comprehensively all the data required for the preparation of an electric tramway cost return. The usual accounting method of dealing with stores is to debit a stores account with the stores received and to credit the supplier with the purchase. The stores received are entered in the Stores Received Book (Schedule 1), and the stores issued in the Stores Issued Book (Schedule 2). The former book is posted to the debit and the latter to the credit of appropriate accounts raised in the Stores Ledger (Schedule 3), the total of the balances of the various stores accounts

indicating the value of the stores on hand. Stores, naturally, are only issued upon the production of, and in exchange for, properly authenticated requisitions, as per Schedule 4.

Periodically—say every four weeks or 28 days, or for any other adopted period—a statement, showing on the one hand the stores received and taken into stock, and on the other the stores issued, is prepared, the form of which may be as per Schedules 5 and 6. The information for the supply of the columns on the left-hand side—that is, goods received—and the information for the columns on the right-hand side—that is, goods issued—may be obtained readily from the Stores Received and Stores Issued books. The balance of the statement, when the receipts exceed the issues, represents the book value of the stores in hand.

The wages sheet is prepared weekly, of course, from the time sheets and other sources, and may be in the form of Schedule 7.

Schedule 9.

Description.		Amount.	Total.	Per car-mile. This year.	Per car-mile. Last year.
Forward					
CARS AND CAR EQUIPMENTS—					
Wages					
Salaries					
Repairs and maintenance—					
Car bodies	wages.....				
	stores.....				
Motors and controllers	wages.....				
	stores.....				
Trucks and gear	wages.....				
	stores.....				
Axles and wheels	wages.....				
	stores.....				
Trolley poles and wheels	wages.....				
	stores.....				
Lighting equipments	wages.....				
	stores.....				
Sundries					
Total					
ADMINISTRATION CHARGES— (Chief Office.)					
(Particulars)					
Total					
Aggregate for period					

Schedule 9.

STATISTICAL SUMMARY

	Description.	This year.	Last year.
1	Route mileage of lines operated		
2.	Number of car-miles run		
3.	„ car-hours		
4.	„ service hours		
5.	Receipts per car-mile		
6.	„ per car per day		
7.	„ per route-mile		
8.	„ per passenger		
9.	Expenditure per route-mile		
10.	„ per car-mile		
11.	„ per passenger		
12.	Units generated and/or purchased		
13.	„ sent out from station		
14.	„ used in offices and works		
15.	„ used in street lighting		
16.	„ sent out to cars		
17.	„ per car-mile		
18.	Maximum demand (KW.) of traction load ...		
19.	Units per mile		
20.	No. of car-miles per car-hour—*i.e.*, $\frac{\text{car-miles}}{\text{car-hours}}$		
21.	Lost mileage		

State of weather.	This year.	Last year.
First week		
Second week		
Third week		
Fourth week		

No. of passengers carried at each fare.	This year.	Last year.
$\frac{1}{2}$		
1		
$1\frac{1}{2}$		
2		
3		

Schedule 8 is representative of the salaries, and is compiled monthly, whilst the petty cash expenditure is subject to analysis on similar lines. For the reception of the expenditure as shown by the periodical wages, salaries, stores, and petty cash allocations, appropriate accounts are raised in the ledger, to which the expenditure is posted by journal entries debiting the various accounts to which the different classes of expenditure refer, and crediting wages, salaries, or stores account, as the case may be. The element of estimating is ever prominent in varying degrees in costing, and, if we are to impose reasonable limitations upon it, some attention must be devoted to undue, and in some cases absolutely useless, disintegration or segregation of itemised cost.

The cost statement, which may be designed as per form 9, is compiled from the wages, salaries, stores and petty cash revenue allocations, and is therefore merely the product of the tabulation and incorporation of the revenue information contained in these sheets for a uniform period, with the addition of the head office, general and administrative charges, which, in the case of an undertaking which is entirely running, can be readily and accurately estimated.

(*To be continued.*)

THE LOADING OF TELEPHONE CABLE CIRCUITS.

BY A. W. MARTIN.

A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

INTRODUCTION.

IN any telephone circuit there are at least four factors which exert a marked influence upon the transmission of the electric impulses, waves or rapidly alternating currents, which are convertible into speech by means of a telephone receiver. These factors are :—

(*a*) Resistance.
(*b*) Inductance.
(*c*) Electrostatic capacity.
(*d*) Leakance (reciprocal of insulation resistance).

There is no definite relationship between these quantities in the sense that if three be known the fourth can be determined ; consequently, the investigation of their joint influence upon the transmission of speech is a matter of some complexity. It is not, however, so complex but that anyone acquainted with the ordinary laws connecting the well-known electrical quantities may follow the consideration if a little mathematical knowledge be possessed.

Four quantities have been named above ; but there are others not so obviously included. When any current of varying strength—particularly one of high frequency such as a telephonic current—flows through a circuit, eddy currents are produced in any mass of conducting material near the main conductor, and such currents react upon those producing them so as to retard the rise and fall in strength. Again, if there be iron near the main conductor, the iron will be reversely magnetised with each alternation of the current, and for every cycle through which the magnetisation is carried there will be a definite hysteresis loss in the iron.

So far as the main, or telephone, circuit is concerned, there is a certain loss of energy due to eddy currents and the hysteresis in the iron. It should be noted that these losses are *absolute* and not comparable with inductance and capacity effects in which energy is stored, not lost. The energy lost in any circuit is proportional to C^2R, where C is the current strength and R the resistance. If eddy currents and hysteresis losses produce the same effect as a resistance in limiting the current strength, they may be represented by a resistance, and, clearly, such a so-called resistance is an addition to the ordinary resistance of the circuit as measured under steady current conditions. The term *effective resistance* is used to denote ohmic resistance (or that offered to steady currents) plus that due to the effect of eddy currents and hysteresis.

In any ordinary telephone circuit consisting of overhead, underground or submarine wires revolved, without special treatment, the effective resistance is not very much greater than the ohmic resistance ; indeed, the difference is so small as to be practically negligible. *Do not, however, imagine that this is the case where inductance or loading coils are placed in a circuit, or where inductance is increased by coating the conductor with magnetic material, such as a layer (or layers) of iron wire.* As will be mentioned later, the effective resistance in these cases is vastly different from the ohmic ; either owing to the presence of the mass of iron used in the loading coils and the copper of which the coils are formed, or to the mass of iron distributed uniformly over the conductor as the case may be.

The subject of effective resistance has been emphasised early, because it is a matter of the utmost importance, and is unfortunately overlooked by many observers. Methods of increasing the inductance of a circuit are not difficult to find ; the real difficulty is to devise a method of introducing inductance without largely increasing the effective resistance.

In circuits free from iron, the inductance may be regarded as constant for all currents and frequencies ; but if iron be present, as in the case of circuits loaded with iron core coils, this is not absolutely true. By properly selecting the quality and arranging the quantity of iron or other magnetic material used, a very close approximation to uniformity of inductance values for all important telephonic frequencies may, however, be obtained. In what follows, it will be understood that the inductance considered is that measured at the frequency assumed in the particular cases ; but it may at once be stated that for all frequencies between 500 and 2,000 per second, the loading coils (with or without iron) used in practice are constant in inductance for telephonic currents.

Part I.

Any treatise on algebra dealing with exponential and logarithmic series will show that, if—

$$e = 1 + 1 + \frac{1}{\lfloor 2} + \frac{1}{\lfloor 3} + \ldots \text{ \&c.},$$

$$\text{then } \mathrm{M}\, e^{ax} = \mathrm{M}\left(1 + ax + \frac{a^2 x^2}{\lfloor 2} + \frac{a^3 x^3}{\lfloor 3} + \ldots \text{ \&c.}\right),$$

where M is a constant.

If this expression be differentiated with respect to x, then

$$\frac{d(\mathrm{M}\, e^{ax})}{dx} = \mathrm{M}\left(0 + a + a^2 x + \frac{a^3 x^2}{\lfloor 2} + \frac{a^4 x^3}{\lfloor 3} + \ldots \text{ \&c.}\right),$$

$$= \mathrm{M}\, a\left(1 + ax + \frac{a^2 x^2}{\lfloor 2} + \frac{a^3 x^3}{\lfloor 3} + \ldots \text{ \&c.}\right),$$

$$= \mathrm{M}\, a e^{ax}.$$

Put $y = \mathrm{M} e^{ax}$, and the following relation is obtained—

$$\frac{dy}{dx} = ay.$$

From this it is argued that when the rate of increase of any quantity, y, with respect to another, x, is proportional to itself, it obeys the relation—

$$y = \mathrm{M}\, e^{ax}.$$

If a further step be taken and the expression for $\mathrm{M}\, e^{ax}$ be differentiated twice, then—

$$\frac{d^2 y}{dx^2} = \frac{d(\mathrm{M}\, a\, e^{ax})}{dx} = \mathrm{M}\, a^2 e^{ax},$$

or, since $y = \mathrm{M}\, e^{ax}$,

$$\frac{d^2 y}{dx^2} = a^2 y.$$

This is all very straightforward when one meets with $y = \mathrm{M}\, e^{ax}$, but when one begins with an equation such as—

$$\frac{d^2 y}{dx^2} = a^2 y,$$

it does not follow that—

$$y = \mathrm{M}\, e^{ax} \textit{ simply.}$$

Let $y = \mathrm{M}\, e^{ax} + \mathrm{N}\, e^{-ax}$,

then $\frac{dy}{dx} = \mathrm{M}\, a\, e^{ax} - \mathrm{N}\, a e^{-ax}$,

and $\frac{d^2 y}{dx^2} = \mathrm{M}\, a^2 e^{ax} + \mathrm{N}\, a^2 e^{-ax}$,

$= a^2 (\mathrm{M}\, e^{ax} + \mathrm{N}\, e^{-ax})$,

$= a^2 y.$

By trial, therefore, it is seen that—

$$y = \mathrm{M}\, e^{ax} + \mathrm{N}\, e^{-ax}$$

is a solution of the equation—

$$\frac{d^2 y}{dx^2} = a^2 y.$$

(See Boole's "Differential Equations," Second Edition, Chapter IX, page 194.)

As a matter of fact, one may put y equal to as many terms in e as one pleases, so long as the powers to which e is raised are kept equal to ax and $-ax$ respectively. In the above expression M stands for the algebraic sum of all the coefficients of terms in e^{ax} and N represents that of all the coefficients of terms in e^{-ax}.

Proceeding now to the consideration of a telephone circuit, let it first be understood that every sound used in normal speech is composed of a number of superposed sound waves. Suppose three of these waves to be as shown by a, b and c in fig. 1, the resulting wave would be of the form

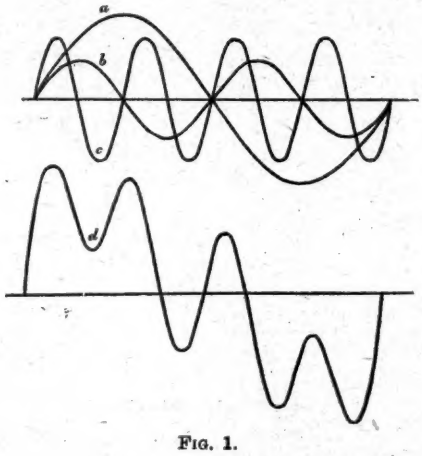


Fig. 1.

shown by d. It is unnecessary here to enter into detail as to the manner of converting sound waves in air into currents of electricity, of varying strength, in an electric circuit, but it is essential to bear in mind that if perfect telephonic transmission is to be obtained, the circuit must be capable of transmitting currents, the variation in the strengths of which, if plotted, would show the same resultant wave form as the speech wave itself—such as d, fig. 1. The variation of telephonic voltages and current strengths clearly may be assumed to obey the general laws for periodic E.M.F.'s and currents of high frequency.

The following symbols will be used hereafter, others being employed and defined as required :—

R = effective resistance in ohms per mile of loop.

L = effective inductance in henrys per mile of loop.

K = electrostatic capacity in farads per mile wire to wire.

S = leakance in mhos per mile wire to wire. (Or reciprocal of the insulation resistance in ohms per mile wire to wire.)

p = 2 π times the periodicity per second.

In fig. 2, let A B be a looped circuit ; at A let there be a means of impressing an alternating E.M.F. Take any extremely small length of the loop—say, at P—and call it Δx. Suppose that, at the instant considered, the upper wire as viewed in the figure, is at a positive, and the lower at a negative potential ; and, that the dotted lines represent the way in which the potentials change along the wires of

the loop in the neighbourhood of P. Next, for the sake of convenience, imagine the short length Δx to be re-drawn on a very enlarged scale as in figs. 3 and 4. Consider, first, fig. 3. If C be the instantaneous current strength in the length of loop Δx, then the fall of potential difference

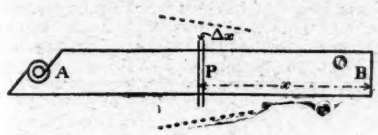


FIG. 2.

between the wires in the direction A to B (see fig. 2), or the rise from B to A, due to the joint effects of the resistance $R\Delta x$ and the inductance $L\Delta x$, will be $CR\Delta x + L\Delta x \frac{dC}{dt}$, so that, if V be the difference of potential at the right end, that at the left will be $V + \left(CR + L\frac{dC}{dt}\right)\Delta x$. As Δx is extremely small, no grave error will arise if it be assumed that the instantaneous difference of potential between the upper and lower wires of the short length is V,

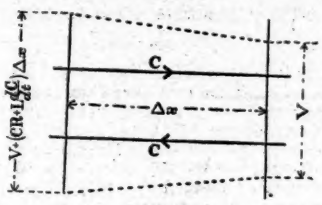


FIG. 3.

and that ΔV represents the small change of potential difference between the ends of Δx. In which case, and considering B to A—

$$\Delta V = \left(CR + L\frac{dC}{dt}\right)\Delta x,$$

$$\frac{\Delta V}{\Delta x} = CR + L\frac{dC}{dt} \text{ nearly,}$$

and if Δx be made less than any assignable magnitude then, absolutely—

$$\frac{dV}{dx} = CR + L\frac{dC}{dt}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Now, consider fig. 4; where the length Δx is the same as in the preceding case. The leakance between the two wires will be $S\Delta x$, and the electrostatic capacity $K\Delta x$. If the instantaneous difference of potential between the wires of the short length of loop be V, then

FIG. 4.

the current leaking across the dielectric from wire to wire will be $V S \Delta x$. In addition there will be required a quantity of electricity to satisfy the electrostatic capacity of the length Δx, and this quantity, expressed as a current strength, is equal to $K\Delta x \frac{dV}{dt}$. If C be the current at the right end of the short length of loop, then that at the left end will be $C + \left(SV + K\frac{dV}{dt}\right)\Delta x$. The decrease of current strength from A towards B (see fig. 2), or the increase from B to A due to the combined effects of leakage and capacity, will therefore be $\left(SV + K\frac{dV}{dt}\right)\Delta x$. Again, as Δx is extremely small, no grave error will arise if it be assumed that the instantaneous current strength in the wires of the short length of loop is C, and that ΔC represents the small change in current strength between the ends of Δx. In which case and considering B to A—

$$\Delta C = \left(SV + K\frac{dV}{dt}\right)\Delta x,$$

$$\frac{\Delta C}{\Delta x} = SV + K\frac{dV}{dt} \text{ nearly,}$$

and if, as before, Δx be made less than any assignable magnitude, then, absolutely—

$$\frac{dC}{dx} = SV + K\frac{dV}{dt}. \quad . \quad . \quad . \quad . \quad . \quad (2)$$

It is from the equations (1) and (2) that the whole theory of telephonic transmission, so far as lines, at least, are concerned, is built up.

(To be continued.)

PROCEEDINGS OF INSTITUTIONS.

Experiments on Single and Stranded Low-Tension Fuses.

By W. T. MACCALL, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS *at Leeds, November 17th,* 1909.)

FOR a single-wire fuse the usual formula is that due to Sir William Preece, viz.:—

$$C = k \cdot D^{\frac{3}{2}},$$

where—

C = fusing current in amperes;
D = diameter of wire in inches;
k = constant for any particular metal or alloy,

its value being about 10,244 for copper, 1,642 for tin, and 1,379 for lead.

These constants are proportional to $\sqrt{T E/P}$, where—

T = rise of temperature to fuse the wire;
P = resistivity at temperature of fusion;
E = emissivity " "

The emissivity of wires varies with the diameter, a fact apparently not recognised by the suppliers of fuse wire, who generally give Preece's table, which neglects this variation. When fuses are stranded, the constant is further modified by the mutual influence of the wires. Experiments were undertaken to determine the variations in Preece's constant with change of diameter, the effect on fusing current of house-service fuse-holders, and the ratio of the fusing currents of single and stranded fuses in the open, and in holders.

The current was slowly increased by small increments, with a pause of one minute at each step. Some experiments were made with the fuses horizontal, but it was found preferable to have them vertical, as in practice. For the experiments in air, large terminals, $\frac{7}{8}$ in. in diameter, with centres 3 in. apart, were used; the porcelain

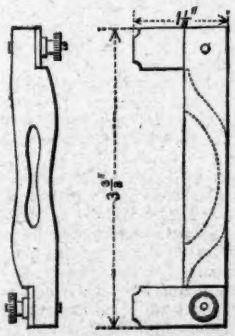


FIG. 1.

fuse-holder employed had copper end-pieces with nuts and washers, as in fig. 1. The experiments were confined to tin fuses, the wire containing 99·6 per cent. of tin.

The results for single wires were as follows (air temperature 16° C.):—

Single Wires.

Diameter. Mils.	S.W.G.	In air or fuse-holder.	N.F.C. Amperes.	$10^3 \times E$.	$k \div 10^9$.
15·3	28	Air	3·58	2·60	1·89
21·9	24	,,	5·26	2·42	1·66
28·6	22	,,	7·53	1·77	1·56
15·3	28	Holder	4·58	4·27	2·42
21·9	24	,,	6·28	3·44	1·94
28·6	22	,,	8·17	2·08	1·69

The value for 28 S.W.G. in air is with fuse horizontal, all others with fuse vertical.

It will be seen that the values of E and of k decrease with increasing diameter, especially for fuses in holders; in the latter case the N.F.C. (normal fusing current) instead of varying as d^3, does not vary even as rapidly as the diameter, but about as its 0·92 power.

In all cases a wire carries more current before fusing in a holder than the same wire in the air, but the increase is most marked for the smaller wires.

Passing on to two-stranded fuses, the question arises as to the effect of more or less twist of the wires. To avoid complication from this source, the amount of twist was kept moderate and approximately proportional to the diameters of the wires.

Two-Strand Fuses.

Diameter. Mils.	S.W.G.	Twists per inch.	In air or fuse-holder.	N.F.C. amperes.	$10^3 \times E$.	$\frac{k}{10^9}$
15·3	28	$3\frac{3}{4}$	Air	5·37	1·47	1·42
21·9	24	3	,,	8·85	1·37	1·37
28·6	22	2	,,	13·0	1·32	1·34
15·3	28	$3\frac{1}{4}$	Holder	6·37	2·06	1·68
21·9	24	$2\frac{3}{4}$	,,	9·38	1·53	1·44
28·6	22	$2\frac{1}{4}$	,,	13·4	1·52	1·39

The same general results are seen here as for the single fuses, except that k varies less, especially in air.

Comparing the two sets of results we obtained the following:—

Ratio of N.F.C.'s for Single and Double Fuses.

S.W.G.	In air or fuse-holder.	$\frac{\text{N.F.C. for two-strand.}}{\text{N.F.C. for single.}}$
28	Air	1·50
24	,,	1·68
22	,,	1·73
28	Holder	1·39
24	,,	1·49
22	,,	1·64

The first figure is affected by the position of fuse being horizontal, so that probably the ratio is fairly constant in air. The increasing values with increasing diameter for wires in the holder are due to the diminishing effect of the holder, so that these values gradually approximate to those for fuses in air.

Discussion.

Mr. A. J. Cridge said that further experiments were necessary, especially with regard to different numbers of strands and the amount of twisting. He had known men who, not having the gauge of fuse wire required, had taken a piece of wire of larger gauge, and reduced its cross-section by stretching. This was a most inaccurate way of trying to arrive at the required result.

Mr. H. E. Yerbury said these experiments were valuable, though if one must allow such a large margin or factor of safety in all fuses used for domestic and industrial purposes, the difference in fusing point with different types of holders and in air would be ignored by practical men.

Mr. E. J. Marsh asked what result would be obtained with two similar fuses in series, one in air and the other enclosed in a holder. Would the fuse in air blow first on a short-circuit? Experiments with cartridge fuses would be of considerable interest.

Mr. T. W. Sampson said the effect of the holder on the fuse seemed contrary to what one would expect to find. Regarding the twisting effect, there was not twice the amount of radiating surface when the wires were twisted as when they were straight. Therefore they had a longer length and less radiating surface, which would have the effect of reducing the fusing current.

Mr. W. H. L. James (Bradford), in a communication, said that Mr. Maccall's experiments on single wires confirmed the results given by Prof. Schwartz and himself, as to the considerable and variable departures from Preece's law which occurred in practice. Mr. Maccall had been rather unfortunate in his choice of fuse-holder. In the type used, even if the wire was quite tight when put in, it would expand slightly before fusion, and the degree of contact between the cooling porcelain surface and the fuse-holder would be of a variable and uncertain nature. The statement that in all cases a wire carried more current before fusing in a holder than the same wire in air, though true for the type of holder made use of, was not true for every type of fuse-holder. If a tubular fuse-holder were used with the wire going down the centre (out of contact with the porcelain), the N.F.C. might be lower in the holder than in the open air.

Mr. W. M. Rogerson said he found that aluminium as a fuse, gave far better results in the case of heavy currents, than tin or copper. Copper fused practically the whole length, whereas with aluminium a small portion only was affected. In Halifax they had adopted aluminium altogther for fuses, with excellent results.

Mr. W. T. Maccall, in reply, said he thought that for wires of small diameter, *e.g.*, 28 S.W.G., which was often used, having a fusing current of 3 or 4 amperes, and even for 24 S.W.G., the difference produced by placing the wire in the holder was sufficiently important to matter, especially as it was an increase in the fusing current. He had not done any experiments on short circuits, but he thought that the difference in fusing current would be sufficient to make the one in air fuse first. He had noticed that it made quite a considerable change in the fusing current if the wire were put in the holder loosely instead of tightly. He thought that in the actual experiments the effect was not very great. Three strands carried a little more than twice as much as one, and a double strand carried 1·5 times as much as a single.

Recent Developments in the Transmission of Electrical Energy.

By Prof. E. W. Marchant, D.Sc., Member, and E. A. Watson, M.Sc., Student.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, November 30th*, 1909.)

Introduction.

The transmission of electrical energy over long distances has received far greater attention in America than on the Continent of Europe. At Niagara there are five power stations for the supply of electrical energy, giving a maximum output of 320,000 H.P. These supply power over a distance of 150 miles; very shortly this distance will be extended to 250 miles. The effect of this vast source of power on the industrial development of the district in which it is placed has been enormous. At the present time it is estimated that a population of 40 million people resides within the area which represents the field of distribution for Niagara Falls, and in future years, as the electrification of the railways progresses, it is certain that the Niagara district will become an unrivalled centre for manufacturing industries. In no other single place in the world (except possibly at the Victoria Falls of the Zambesi) is there located so vast a supply of power.

On the Pacific Coast the problem has been of an entirely different character. Large towns have sprung into existence chiefly as the result of mining and agricultural enterprise, and as fuel is expensive, the supply of electrical energy for lighting and tramways from water-power has led to the development of many comparatively small powers, the energy from which is distributed sometimes for as great a distance as 250 miles.

For the supply of electric power to the City of San Francisco, which is under the management of the Pacific Gas and Electric Co., no less than 11 water-powers are connected to the system, the power for which is obtained from water used for irrigation purposes; these are coupled in parallel on a single network, covering in all an area of 30,000 square miles, extending nearly 250 miles along the Pacific Coast. The total length of 60,000-volt overhead line on this network is over 1,000 miles.

A great factor in making these systems a commercial success is undoubtedly the low price of land and the cheap rate at which wayleaves can be obtained.

The longest distance over which water is carried is at the Electra station, where the distance from the source of supply to the reservoir is 30 miles. There are, however, many other cases in which water is carried several miles before it can be used for power purposes.

A study of these stations makes it evident that many water-powers in this country which have hardly been considered as of practical utility, may ultimately be developed to the great benefit of the surrounding district, provided that the necessary wayleaves for the transmission lines can be obtained at a reasonable rate. In this connection too great emphasis can hardly be laid on the advantage which a new country possesses in having land which can be used for purposes of this kind without payment of heavy dues, though it may be hoped that even in this country, when the great economic and industrial advantages of a cheap supply of electrical energy are thoroughly understood, it may be possible to use transmission lines over distances much greater than have hitherto been attempted.

The standard pressure at present in use is 60,000 volts, three-phase. This pressure is used in nearly all transmissions of 50 miles and over, and appears to give rise to no practical difficulties in operation. In several cases stations have been designed for pressures up to 110,000 volts; in many of these, lower pressures are being used until the load on the station is sufficiently large to necessitate the higher pressure being employed. The station at Island Bar commenced operation at 110,000 volts on October 1st, 1909, along its transmission line of 153 miles, while that of the Central Colorado Power Co. at Shoshone has been in operation at a pressure of 90,000 volts since May, 1909. The efficiency of transmission over these distances is usually figured at 90 per cent., and

it can be maintained nearly constant as the load on the station increases, by raising the working pressure.

Higher voltages are undoubtedly possible at the higher altitudes of Colorado and the Nevada's than could be used on similar installations in our great manufacturing districts; but, allowing for all effects of climate and atmosphere, there is no doubt that there is no great technical difficulty involved in the use of much higher voltages than have hitherto been attempted in this country.

At the present time, the possible voltage is only limited by the production of a corona or brush discharge from the line itself.

This corona is due to the electric stress produced in the neighbourhood of the wire, by the electrostatic charge which it carries being greater than the air can stand. Disruption of the zone of air next the wire takes place, accompanied by light, sound and chemical effects, and a serious loss of energy. A corona on a high-tension line must never be allowed, as the power loss which accompanies it will amount to a very considerable figure.

The stress which will be produced in the air at the surface of a transmission line depends on the potential difference between lines, the diameter of the wire and the distance apart of the wires.

The value of the electric stress which can be allowed in the neighbourhood of a transmission line depends on a good many factors. It has been demonstrated beyond any doubt that it

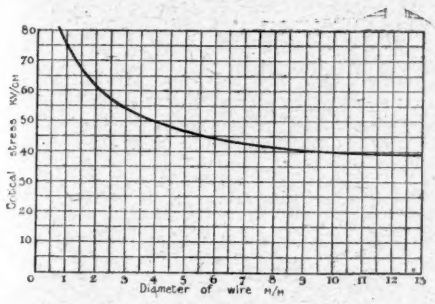


FIG. 1.—RELATION BETWEEN "R" (ELECTRIC STRESS) AND THE DIAMETER OF THE WIRE.

depends to some extent upon the size of the conductor, rising as the conductor size decreases, according to the curve shown in fig. 1. Secondly, the electric strength of the air is known to become less as the atmospheric pressure is decreased, so that at high altitudes a corona is more easily formed than at low ones, the relation between electric strength and air pressure being given approximately by the expression—

$$R = R_0 (0{\cdot}2 + 0{\cdot}8\, p/760),$$

where p is the pressure in millimetres of mercury.

A similar lessening of the electric strength is also produced by an increase of temperature, the law being linear in this case also.

The voltage of discharge from a perfectly clean wire seems to be little affected by the presence of water vapour in the atmosphere; but if the wire be dirty, not only does the discharge in any case occur at a lower voltage, but the voltage is lowered still further if water vapour is present. For this reason there has been considerable discrepancy between the results obtained by various workers on the subject.

For the present it is suggested that the figures given in fig. 1 should be used, combined with a factor of safety which should have, approximately, the following values:—

Large towns or industrial districts especially near sea-level, *e.g.*, Lancashire, &c.	1·8-2·0
Ordinary open English country	1·5
Mountainous or other districts far from any source of contamination of the air	1·2

The systems which use a working voltage approaching the possible maximum are as yet but few in number. The ordinary 60,000-volt plant, of which there are numerous examples throughout America, does not approach the limit, except it be on an occasional short feeder of small diameter. The main transmission line of a 60,000-volt scheme, even if of copper, is rarely less than 000 B. and S., or ·47 in. diameter, and very often an aluminium conductor of considerably larger size is employed.

The lines which are at present being worked at voltages approaching the limit, the stresses existing on these lines, and the factor of safety which has been allowed, are given below:—

Plant.	Voltage.	Conductor. B. and S.	Spacing.	Altitude.	Stress.	Factor of safety.
			Cm.	Ft.	kv./cm.	Allowing for altitude.
Great Western Power Co., Island Bar	110,000	000	300	800	24·2	1·52
	150,000	—	—	—	33·0	1·11
Central Colorado Power Co.	110,000	00, 7-strand with hemp core	300	6,000	23·2	1·34
Grand Rapids ...	100,000	0000	300	1,000	19·6	1·87

With the exception of the few comparatively small plants installed in France and Switzerland, all the modern transmission schemes employ three-phase alternating current. Undoubtedly, for a very long transmission from a remote source of power, such as a waterfall to a large city or industrial area, the Thury system of direct-current transmission has many advantages.

In the first place, the working voltage with a direct-current line may be much higher than that which is possible with an alternating current one, as the effects which limit the alternating voltage available, such as the corona, depend not upon the R.M.S., but upon the maximum value of the voltage used.

The charging current of the line in an alternating current transmission is a factor needing serious consideration, especially when a frequency of 60 (frequently used in the States) is adopted.

The possibility of resonance (not really very serious) and the danger of interference with telephone and telephone circuits, also militate against the use of alternating currents.

On the other hand, the elasticity of the alternating-current system, with its parallel method of working, renders it very suitable for the large networks of power lines which are springing up all over the American Continent.

The question of frequency is settled more by the question of standardisation than by any other consideration.

The standard frequencies on the American Continent are 25 and 60 cycles, the latter being used almost universally for lighting purposes. It is, however, distinctly too high for a really sound long-distance transmission. There seems to be a great aversion to using 25-cycle current for lighting, although in one or two towns this is done. The large plants on the Pacific Coast all use 60 cycles and have very large charging currents. One plant in particular, which will ultimately operate a line 153 miles long at 110,000 volts, will have a charging current corresponding to an output of nearly 15,000 KVA. In at least one case, the question of the charging current due to the high frequency has limited the value of the transmission voltage employed.

It seems unfortunate that the excessive standardisation prevailing among the manufacturers of electrical machinery should cause the adoption of such an admittedly unsatisfactory frequency as 60 cycles per second.

The operation of a number of widely distributed central stations on a common distributing network has presented few difficulties in actual practice. The methods adopted for synchronising the machines are similar to those employed in this country, rotary synchronisers being most commonly used. In many cases water-power plants are running in parallel with steam turbines through 100 miles of line, and no difficulty from hunting has been met with.

The latest practice to facilitate good synchronising is the use of pneumatically controlled switches. These are much quicker in operation than any other form of switch yet put into service, and the new switch has the advantage of being independent of the judgment of the operator.

As a matter of fact, synchronising through a long transmission line is a much easier matter than synchronising in a central station.

The practice of switching-in machines without synchronising is not common in hydro-electric stations, though in the General Electric Co.'s works at Schenectady, synchronous motors and converters are put into circuit in this way, the motors being fitted with copper damping rings to give the necessary starting torque and bring them up to speed.

The protection of the overhead line against lightning stroke and atmospheric discharges is a matter of great importance. American engineers state that this problem is one of the most serious that they have to face, and the opinion is very generally held that no so-called lightning arrester is effective in protecting a transmission line against the effect of lightning stroke. In nearly every station that was visited the old arresters are being displaced by those of the electrolytic type. These arresters are kept charged by being connected every other day direct to the overhead line, but normally they are arranged with a spark-gap between them and the line. Even on a long line arresters are fitted only at the central station and at the sub-stations, the extra safety gained by fitting them at intermediate points being discounted by the increased risk of breakdown due to their use.

The most effective protection against lightning is undoubtedly the earthed wire. During a recent very severe lightning storm near San Francisco, the only transmission line that was not put out of service was one having an earthed wire arranged above the line. Not only does the earthed wire act as a screen against the electrostatic effect by charged clouds moving in the upper regions of the atmosphere, but it also provides a path to earth more direct than that of the line wire over the whole length of the transmission line, and thus prevents a lightning stroke from striking the transmission line. In most cases where the earthed wire is fitted, however, the best practice is to connect a lightning arrester of the ordinary type to the line as an additional safeguard.

Troubles from lightning are much less likely to occur on a high-voltage transmission line than on those working at 20 or 30 kilovolts, on account of the more effective insulation of the line.

In no stations are there water-jet dischargers installed in which an electrostatic charge is conveyed to earth through a water jet playing against the line. With the high voltage used, it is obvious that the resistance of the water, if there is to be no considerable leakage current, would have to be so high that it would not be sufficiently conducting to get rid of an electrostatic charge with any great rapidity.

It has been suggested at various times that asynchronous generators consisting of ordinary induction motors run above synchronous speed could, with advantage, be employed in many transmission systems. This is especially the case in large networks

fed from a number of stations. On some of these networks where there are many small water-powers the use of such a small generator has many advantages. It is extremely robust and mechanical in construction, and quite simple in operation; it needs no exciter and has no rubbing contacts. It can be thrown straight on to the line without synchronising, and it can be short-circuited with impunity. It requires, of course, that the current at the station shall lead on the voltage in order to supply the necessary magnetising component. This is not generally a disadvantage, as on all high-tension long-distance transmission lines the heavy charging current will look after this. An asynchronous generator connected to a line of sufficient capacity will excite itself and furnish power without the use of any synchronous machine to set the step, and on this account care should be taken that the magnetic circuit of such a machine is not worked at too low a density. If an asynchronous machine be taken whose voltage magnetising-current characteristic is given by a straight line—*i.e.*, if the iron is unsaturated, there will always be found a critical value of connected capacity at which the machine just excites. Any increase of the capacity will cause the voltage to rise until the magnetic circuit becomes saturated, and if this occurs much above the normal working voltage, serious damage may result.

Asynchronous stations feeding into networks generally have their governors arranged so that they work steadily at full load all the time. The variable portion of the load is taken care of by ordinary synchronous generators.

An interesting example of the use of asynchronous machines is given by the exciter sets in many of the generating stations of the Pacific Gas and Electric Co. In these sets a water-turbine or Pelton wheel, a direct-current generator, and an induction motor are all coupled together. In case of a heavy load on the generator, the induction motor helps the water-wheel, while, if the load is light, power is returned to the line by the induction motor running as a generator. No governors are provided, the speed being controlled entirely by the induction motor. Synchronous machines had been tried, but had given trouble by breaking step.

An efficient system of telephones is a matter of fundamental importance in the operation of a large network, and the question of telephone interference is, therefore, one which requires most careful consideration. In the case of a transmission line at 100,000 volts and over, no attempt appears to have been made to run the telephone lines on the poles used for the transmission line. With 60,000-volt schemes the usual practice is to arrange the telephone line about 10 ft. below the transmission line, and to support it on insulators on the same poles. In order to avoid mutual induction effects, the telephone lines are transposed at frequent intervals. Transposition of the telephone line is, however, not sufficient to prevent induction, as the inductive effects from the three main lines are sufficiently different in magnitude on the two telephone lines to give large currents along the whole length of line. Electromagnetic induction may be almost completely avoided by transposing both the transmission line and the telephone line. The transposition of the transmission line is effected by using special pairs of towers at intervals of about 3 miles; in most cases the lines are transposed by the third of a revolution at each transposition point. With these precautions the telephone is sufficiently satisfactory, even over a line of 150 miles in length.

If the neutral point of the three-phase system is earthed, this arrangement serves as an efficient safeguard against electrostatic effects, but where Δ-connected transformers are used, and there is no definite earthpoint provided, these effects may be very large. In order to obviate them as far as possible at the telephone, the wires are connected by a split choking-coil at the ends of the line, and the centre point of this coil is connected to earth.

In most of the large installations the telephones are brought to a controlling station, from which all instructions as to the operation of the various plants are issued by a "load dispatcher." The "load dispatcher" gives instructions to each plant as to the number of units which are required to be in operation at the station; all breakdowns of the line are reported to him, so that he knows exactly what sources of power are available for the supply that is required.

The arrangement of the transformer on the high-tension network is one in which considerable discrepancy of practice appears to exist. At the present time there seems to be a decided preference in favour of Δ connection. Briefly stated, the relative advantages of the two methods of connection are as follows:—

Advantages of Δ: (1) If one of the phases breaks down, the other two will supply power to the extent of two-thirds of the capacity of the transformer; (2) if an earth occurs on one leg of the transmission line it does not affect the running of the system provided the insulators on the other two wires are sufficiently large to stand the concatenated pressure of the system.

Advantages of star: (1) The size of insulator used need only be large enough to withstand the star pressure of the system; (2) the neutral point can be earthed and the pressure between each line and earth definitely equalised. This point is of great importance in connection with telephones (as mentioned above).

As a matter of fact, the advantages of the Δ system in enabling the transformer to run with two phases only, if one of the lines break down, is not practically important, as it is found with 60,000-volt working that the insulators installed are rarely large enough to withstand the full-line pressure, and if one of the phases breaks down, the line is put out of service until repairs are effected. The same thing holds good with regard to the transformers. In spite of this, however, Δ connection is much more common than star, and at the Great Western Power Co.'s station, where the change from 60,000 to 110,000 was made on October 1st, 1909, the connection was altered at the same time from star to Δ.

It is remarkable that star working is not more frequently used, as it would appear to be a much more satisfactory arrangement from almost every point of view on extra high-tension systems.

(*To be concluded.*)

Röntgen Society.

At the meeting of the Röntgen Society which took place on December 2nd, Prof. A. W. Porter, B.Sc., gave a demonstration on the subject of electrical discharges on photographic plates. His technique is the usual one followed by previous investigators, such as Mr. J. Brown, of Belfast, and the late Lord Armstrong—namely, a spark from an induction coil producing an electrical discharge over a photographic plate, at the back of which is one terminal in the shape of a copper plate, while the other terminal is a wire brought into contact with the sensitive emulsion. The point at which his experiments part company with those of other observers is in the creation of a partial vacuum around the plate. The negative discharge at atmospheric pressure produces a characteristic and well-known figure, but if the pressure be lowered some remarkable features make their appearance. With a pressure of about 55 centimetres of mercury Prof. Porter found a general tendency for the familar fan-shaped figures to spread out rather more widely and to become more fully developed. At 45 centimetres' pressure a new phenomenon was noted in the shape of a detached triangular figure, sharply pointed, which looked as if it represented the re-aggregation of the discharge after it had been spread out. This bright pointer became much more pronounced at half atmospheric pressure.

He then carried out some experiments by changing the gas surrounding the plate, and found that nitrogen, oxygen, carbon dioxide and ammonia each gave distinct figures, and that it was almost possible to determine the gas through which the discharge had passed by the character of the figure obtained. He suggested the side-splash theory to explain why it was that the discharge in air, starting from the terminal and shooting across the plate, would suddenly send out a branch at right angles to its main line of direction. Each of the finer lines in the figure obtained with the negative spark on a plate probably represented the actual path of one or a group of the small ions into which the composite ion was broken up.

Prof. Porter proceeded to demonstrate the effects obtained by sending a blast of air across the plate and by placing the plate between the poles of an electromagnet while the discharge was being passed. Such a procedure modified that part of the discharge which went right across the plate to the other side. He thought that this part of the discharge consisted of heated air which was made into a conductor, and the effect of the blast of air or of the magnetic field was to blow this heated air on one side. The appearance was as though the plate had been the region of a cyclone. He made a further series of experiments in which the electrode on the sensitive side of the plate consisted of a wire brought down into contact with a small triangle of copper or other metal. In the case of a positive discharge, *i.e.*, one in which the triangle was made the positive terminal, there was a tendency for the streamers to come off from the corners of the plate, while in the case of a negative discharge they came off almost at right angles to the sides of the plate. The fact that the negative discharge came off at right angles seemed to indicate that it was governed much more by the statical conditions than the discharge of the positive. He had been unable to trace any effect due to the plate. Whatever the speed or sensitiveness of the photographic plate, the luminous picture was exactly the same.

THE FÉRY ELECTRICAL PENDULUM.

By Dr. Alfred Gradenwitz.

In order to eliminate the slight deviations from perfect accuracy that still impair the working of mechanically operated pendulums, due to the influence of mechanical friction, even when they are fully compensated for temperature and pressure variations, electric propulsion has been adopted, with a considerable measure of success.

Certain drawbacks are, however, experienced also in connection with electrical pendulums. The oscillating part usually operates the contact used to drive it, and such contacts are apt to interfere with the working of the pendulum. The isochronism of the latter is further disturbed by the effect exerted by the winding-up of the weight or spring, so as to make the pendulum sensitive to the slightest alterations in the amplitude of oscillation.

As a pendulum mainly serves to regulate the working of a clock, it should be touched as little as possible, and should have to perform the minimum of work, in order to be kept at as regular a working rate as possible. In order to comply with these requirement, Prof. Ch. Féry, of Paris, has constructed an electrical pendulum based on a novel principle, which has been under observation for two years in his laboratory.

The most remarkable feature of this pendulum is its complete freedom from contact with solid bodies throughout its oscillations. The regulating device of the pendulum presents some analogy with

the synchronising attachment suggested by Cornu, which has been used by Féry in its original shape in connection with some other pendulum mechanisms. This consists of a fixed coil traversed by the synchronising current, which acts on a bar magnet rigidly connected to the pendulum.

The improvement suggested by Féry is the substitution of a horse-shoe magnet for the bar. Magnets of this kind are far more astatic with regard to magnetic disturbances, and of a considerably more constant magnetic intensity.

The most interesting feature of the novel device, however, is that the other pole of the magnet freely oscillates inside a brass ring C (fig. 1), which constitutes the bob of a small auxiliary pendulum of exactly the same oscillation period as the main

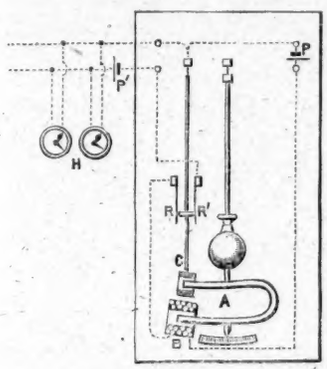


Fig. 1.—Féry Electrical Pendulum.

pendulum. Between the oscillations of the two pendulums there is produced a lag of one-quarter period, the auxiliary pendulum being operated by the reaction due to the currents induced in the ring C.

The function of this auxiliary pendulum is to operate the two contacts RR', the former of which closes the current of a constant battery P connected to the operating coil B, while the other maintains or synchronises the working of the secondary clocks HH by means of the battery P'.

If this pendulum be properly regulated, it will have the important property of starting of its own accord as soon as its terminals are connected to a battery. It can therefore be installed even in an inaccessible place (*e.g.*, in a constant temperature cellar) inside a casing in which the air pressure is maintained constant.

As the consumption of electricity is said to be only about 1 watt-hour per annum, any kind of standard cell can be used for the operation of the pendulum.

The instrument was shown for the first time at the recent annual exhibition of the French Physical Society.

NICKEL WIRE RESISTANCE FURNACES.*

By Dr. M. LEBLANC.

In connection with some experiments which the author has been carrying out on the nitrification of calcium carbide, he has found it necessary to employ temperatures up to 1,300° C. for long periods, and the satisfactory results which he and his collaborator obtained by using a nickel wire resistance furnace led him to determine whether nickel wire could be used also in the construction of small crucible furnaces capable of being connected direct to a 110-volt network.

The first point was to ascertain the correct thickness of wire to employ. After some preliminary experiments it was found that the most suitable thickness was 1 mm. This wire was wound in triple layers round a Pullak cylinder 14 cm. long, 4·5 cm. internal diameter and 1·5 mm. thickness of wall. The distance apart of the individual turns was in the first layer 0·5 mm., in the second 0·8, and in the third 1 mm.; the windings extended along the cylinder for a distance of 12 to 12½ cm., 1 cm. being left free above and 0·5 to 1 cm. below. After winding, the first layer was smeared with a magnesia paste, and a piece of asbestos paper 2 mm. thick was laid upon this to insulate it, the second layer being afterwards wound, and so on. The total length of wire employed was 38·5 m. After being wound the clay cylinder was inserted in an iron (or, better still, aluminium) housing 11 cm. diameter and 22 cm. long, closed at the top by a lid having a suitable opening left, and at the bottom by a clay slab. The outer edge of the cylinder was flush with the lid. The housing was filled in with magnesia for retaining the heat. The ends of the windings conveying the current were covered with nickel wire 1·5 mm. thick, and passed through two terminals fixed in the lower clay slab. The latter was 6½ cm. from the ground, the lower part of the housing being so cut away as to form three legs on which to support it.

After completion, the furnace was connected to a 10-volt 2-ampere circuit to dry it out, being subsequently put on the 110-volt 3-ampere circuit to finish this operation. After being allowed to cool, it was then connected direct to the 110-volt municipal supply (which occasionally showed fluctuations of 10 per cent.), and the following results were obtained:—

Time (minutes).	Current. Amperes.	Temperature. Degrees C.	Time (minutes).	Current. Amperes.	Temperature Degrees C.
0	22	20	30	4·5	1,090
5	6·0	520	50	4·4	1,110
10	5·25	790	60	4·4	1,135
15	5·0	930	153	4·0	1,125
20	4·75	1,000	355	3·6	1,065

With a view to ascertaining the behaviour of the furnace with a longer duration of heating, and also to determine its life, two series of experiments were carried out on two furnaces which differed from that described only in that the clay cylinder had a thickness of wall of 3 mm. In the first series the furnaces were in circuit continuously, and in the second the furnace was disconnected from the supply 23 times, and reconnected after cooling. The first series gave the following results:—

Period of burning hours.	Current. Amperes.	Temperature. Degrees C.	Period of burning hours.	Current. Amperes.	Temperature. Degrees C.
2	4·2	1,130	223	2·7	910
43	3·25	990	256	2·65	880
72	3·0	970	390	2·55	850
127	3·0	940	418	2·5	820
151	2·9	920	437	2·5	800

The furnace was then switched off, and it fell to pieces while cooling.

The second series of tests showed a similar drop in temperature and current. After burning for 351 hours (excluding time taken to cool), the furnace gave, just before burning out, a temperature of 790° with 2·2 amperes.

For many experimental purposes, temperatures up to 300° C. are sufficient, and in these cases the thickness of wire employed can be reduced. Care should be taken when winding to see that there is not a kink in the wire.

From the data given, it seems possible without much trouble to construct other types of furnaces employing nickel wire as the heating unit.

Certain objections have been raised by Carpenter to the use of nickel wire for this purpose, owing to the structural changes which he states take place in it when submitted to high temperatures, but the author holds that nevertheless there are considerable advantages to be derived from the substitution of nickel for platinum, one of the chief being that a laboratory can construct and repair the furnaces in its own workshop. The cost of constructing the nickel-wire furnace is about 10s., as against the price of £4 10s. for a 110-volt Heraeus platinum furnace of smaller dimensions; the cost of renewing the nickel wire is about 3s.

*Abbreviated translation from "Zeitschrift für Elektrochemie," Vol. 15, September 18th, 1909.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—In order to secure entry under the lower scale of duties which has been fixed for goods, the produce of countries receiving most-favoured-nation treatment in Italy, of which the United Kingdom is one, British goods should be accompanied by a certificate of origin issued by Italian Consular officers, Italian Chambers of Commerce in foreign countries, municipal authorities, Chambers of Commerce, foreign Customs authorities or other authorities specially designated by the Ministry of Finance, showing that the country of origin of the goods is a country entitled to most-favoured-nation treatment. By country of origin is understood the country wherein the goods were produced or received their ultimate industrial transformation, whatever, in the case of manufactured goods, be the origin of the raw materials used in their production. When goods proceeding from countries enjoying most-favoured-nation treatment have been supplied to trade, or have entered public or Customs warehouses in a country which does not enjoy such treatment, they cannot claim the benefit of the lower tariff. Certificates of origin must bear the autograph signature of the authority issuing them and the following details:—Name and residence of the consignor of the goods, name and residence of the consignee, quantity marks and numbers of the packages, the quality of the goods according to their commercial denomination, the gross weight of the packages, or such other information sufficient to determine the quantity of the goods, the means of conveyance used for the shipment, and the date on which the certificate was issued.

Lire = 9$\frac{6}{10}$d., or 25 lire = £1. Kilog. = 2·204 lb.

The following duties are payable, the rates given being those of the lower scale referred to above:—

	Lire per 100 kg.
Iron and steel wire:—Having a diameter of 5 mm., or less, but exceeding 1½ mm.	11
Having a diameter of 1½ mm. or less	15
Iron and steel rails for railways	6
Copper, brass or bronze: In bars, sheets and plates ...	14
In wire of a diameter of more than ½ mm.	20
" " " " ½ mm. or less ...	40
Hammered, in coarse articles	18
In ornamental articles not gilt or silvered	75
Gilt or silvered: In bars, sheets or wire...	100
Wound in threads of textile materials	100
Other	120
Articles not specially mentioned	30
Multitubular boilers	14
Other "	12
Steam engines: Fixed (without boiler) or semi-fixed (with boilers), gas and petroleum motors, including rotary motors	12
Hydraulic machinery and water or wind motors including turbines, hydraulic wheels, pulsometers, pumps and elevators, presses, accumulators, lifts, hydraulic jacks, &c.	10
Locomotives without tenders	14
Locomobiles and marine engines	12
Dynamo-electric machines: Weighing more than 1,000 kg.	16
Weighing 1,000 kg. or less...	25
Electric accumulators and metallic parts thereof ...	16
Electric transformers, with or without oil	25

(To be continued.)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,101. "Improvements in telegraph transmitters." G. M. GODDARD, A. C. GROVER and G. C. THRALL. November 22nd. (Complete.)

27,103. "Improvements relating to carbon holders in magneto-ignition apparatus, current distributors or the like." Firm of R. BOSCH. (Date applied for under Sec. 91 of the Act, July 27th, 1909, being date of application in Germany.) November 22nd. (Complete.)

27,125. "Improvements in electric switches." L. LOMAS. November 22nd.

27,154. "Clockwork mechanism provided with an electric winding device." J. STEIGER and J. BESABCON. November 22nd. (Complete.)

27,172. "Improvements in or connected with electrically-operated frame apparatus." A. H. GIBBINGS. November 23rd.

27,175. "Improvements in electric actions for organs and the like." C. BAMBERGER. November 23rd.

27,183. "Model electric aeroplane." H. W. HORNE. November 23rd.

27,221. "Improvements in and relating to electric storage battery plates." ACCUMULATOREN-FABRIK AKT. GES. (Date applied for under Sec. 91 of the Act, February 11th, 1909, being date of application in Germany.) November 23rd. (Complete.)

27,245. "Improvements in or relating to regulating devices for direct-current dynamos." F. KRUPP AKT. GES. (Date applied for under Sec. 91 of the Act, March 18th, 1909, being date of application in Germany.) November 23rd. (Complete.)

27,252. "Improvements in or relating to rotating magnet wheels for turbo-generators." O. T. BLATHY. November 23rd. (Complete.)

27,270. "Improvements relating to electrical machines." W. A. PRICE. November 23rd.

27,295. "Improved method of and apparatus for heating air or gas by electricity." T. MCCLELLAND, JUN. November 24th.

27,335. "Improvements in electrical standard resistances." W. R. BOUSFIELD. November 24th.

27,355. "Improvements in electric clock-winding devices." M. FALK. November 24th. (Complete.)

27,395. "Improvements in and relating to the transmission of messages by wireless telegraphy or telephony." BRITISH RADIO-TELEGRAPH AND TELEPHONE CO., LTD., and J. G. BALSILLIE. November 24th.

27,410. "Improved method of locking incandescent electric lamps in their holders." G. W. SOMERVILLE and J. BUTLER. November 25th.

27,458. "Improvements in automatic telephone exchanges." SIEMENS BROS. AND CO., LTD. (Siemens & Halske Akt.-Ges.) November 25th. (Complete).

27,473. "Improvements in means for holding globes or shades on the galleries of electric light, gas and other fittings." FALK, STADELMANN & CO., LTD., and W. J. CHARLES. November 25th. (Complete.)

27,478. "Improvements relating to power plants embodying alternating-current generators and motors." H. A. MAVOR and MAVOR & COULSON, LTD. November 25th.

27,481. "Improvements relating to the wireless transmission and reception of electrical energy." B. DICK. November 25th.

27,492. "Motor-car or carriage lamp (electric) to turn in any position without taking lamp from its bracket." H. A. GOFF. November 26th.

27,560. "Electromagnetic igniting device for arc lamps." D. TIMAR. November 26th. (Complete.)

27,604. "System for the production and supply of electricity at given tensions by means of a variable speeded (axle-driven) dynamo in conjunction with a storage battery for railway carriages and other suitable applications." A. A. CRAWFORD. November 26th. (Complete.)

27,621. "Improvements in and relating to the collecting devices of overhead electric tramways and railways." W. H. TURNER. November 27th.

27,641. "Improvements in the method of and connections of rotor and stator bars of electrical machinery." BRUSH ELECTRICAL ENGINEERING CO., LTD. November 27th. (Complete.)

27,646. "Improvements relating to electric lamps." L. FOSTER. November 27th.

27,648. "Improvements in commutators of dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) November 27th.

27,663. "Improved method of controlling electrical quantities by means of sound waves and apparatus therefor." F. J. CHAMBERS. November 27th.

27,674. Improvement in method of charging electric resistance furnaces." A. PETERSON. (Date applied for under Sec. 91 of the Act, January 7th, 1909, being date of application in Sweden.) November 27th. (Complete.)

27,689. "Improved detector of thermal and electrical energy." AMALGAMATED RADIO TELEGRAPH CO. (O. Von Bronk, Germany.) November 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

BOOSTERS FOR TRAIN-LIGHTING SYSTEMS AND THE LIKE. W. Stansfield and J. J. Hall. 16,473. August 5th.

DRIVING SHAFTS ELECTRICALLY AT HIGH SPEEDS. R. Fessenden. 21,481. October 10th. (Date applied for under International Convention, October 31st, 1907.)

MEANS OF ELECTRICALLY HEATING LIQUIDS. J. A. Abbott. 24,038. November 10th.

INCANDESCENT ELECTRIC LAMPS. Soc. Française d'Incandescence par le Gaz (Systeme Auer). 24,212. November 13th. (Date applied for under International Convention, November 12th, 1907.) (Application for Patent of Addition to No. 11,149 of 1909.)

ATTACHMENT FOR THE SPARKING PLUGS OF INTERNAL-COMBUSTION ENGINES. A. Fenviour. 24,525. November 14th.

PROCESS FOR PRODUCING TRANSPARENT, FLEXIBLE, INFUSIBLE, INSULATING MEDIA. K. Winkler. 24,597. November 16th. (Date applied for under International Convention, November 18th, 1907.)

ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 25,465. November 25th.

ELECTRIC SWITCH. Cardwell, Boorman, Ford-Lloyd, Ltd., and C. Stirling. 25,819. November 30th.

MANUFACTURE OF THE JUNCTION AND OTHER FITTINGS OF METALLIC CONDUITS FOR ELECTRIC CONDUCTORS. Charles H. Pugh, Ltd., and G. F. Bull. 26,229. December 4th.

CHEMICAL ELECTROLYTIC PROCESS FOR CLEANING METAL OBJECTS TO BE GALVANISED OR NICKELLED. H. Vollert. 27,034. December 12th.

MOUTHPIECES OF SPEAKING TUBES AND TELEPHONES. H. James. 27,332. December 16th.

CONTROLLERS FOR ELECTRIC MOTORS. British Thomson-Houston Co. (General Electric Co.) 28,188. December 24th.

1909.

ELECTRICALLY-OPERATED VISUAL SIGNALS FOR RAILWAYS. W. C. S. Coan. 256. January 5th. (Post-dated May 19th, 1909.)

CONTACT BREAKERS FOR USE WITH MAGNETO-ELECTRIC MACHINES. F. R. Simms and Simms Manufacturing Co. 1,641. January 22nd.

IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. T. B. Smith. 3,469. February 12th.

MEANS FOR ACTUATING THE CONTACT ARMS OR LEVERS OF ELECTRIC SWITCHES. A. H. Curtis, A. H. Mackley and Adams Manufg. Co. 4,111. February 11th.

RECEIVERS FOR WIRELESS TELEGRAPHY. Marconi and Marconi's Wireless Telegraph Co. 4,125. February 19th.

ELECTRIC LIGHTING SYSTEMS IN WHICH LAMPS ARE ARRANGED IN SERIES. C. H. Stearn and C. E. Topham. 4,694. February 25th.

ELECTRIC GENERATORS GIVING CONSTANT PRESSURE UNDER VARYING SPEEDS. R. Derain. 4,837. February 27th. (Request under Sec. 19 not granted.)

CONSTANT-TENSION WINDING AND PAYING-OUT APPARATUS ESPECIALLY ADAPTED FOR MARINE CABLEWAYS FOR LIFE-SAVING AND OTHER PURPOSES. T. Miller. 5,903. March 11th.

TIME-LIMIT DEVICES FOR USE IN CONNECTION WITH ELECTRO-MAGNETIC CIRCUIT BREAKERS. Electric & Ordnance Accessories Co. and N. Collins. 7,275. March 26th.

ELECTRIC FUSE BOXES. R. Sheeby. 10,796. May 6th.

ELECTRICAL SWITCHES. A. P. Lundberg, G. R. Lundberg and P. A. Lundberg. 11,605. May 17th.

MANUFACTURE OF ELECTRICAL CONDENSERS. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 13,135. June 4th.

METAL BOXES FOR SWITCHES AND WALL PLUGS. C. A. Backman. 14,062. June 15th.

NON-INTERCHANGEABLE SAFETY FUSES FOR ELECTRICAL CIRCUITS. Siemens Schuckerwerke Ges. 14,622. June 22nd. (Date applied for under International Convention, June 23rd, 1908.)

TELEPHONIC RECEIVERS. W. R. Webb. 15,657. July 5th.

ELECTRIC HEATERS FOR FLUIDS OR LIQUIDS. Ponzini. 15,786. July 7th.

ELECTRIC SIGNALLING SYSTEMS FOR RAILWAYS AND THE LIKE. J. D. Taylor. 15,978. July 8th. (Date applied for under International Convention, January 30th, 1908.)

CONTROL OF POLYPHASE MOTORS AND THE LIKE. Allgemeine Elektricitäts Ges. 17,758. July 30th. (Date applied for under International Convention, July 31st, 1908.)

ELECTRIC INSOLES FOR SHOES, BOOTS AND THE LIKE. O. Rampelbergh. 18,409. August 10th.

COOLING DYNAMO-ELECTRIC MACHINES. Siemens Bros. Dynamo Works. (Siemens Schuckerwerke Ges.) 22,789. October 6th.

DEVICES FOR THE LOCKING OF ELECTRIC LAMPS IN THEIR HOLDERS. T. McClellard. 299. January 6th.

METAL-FILAMENT ELECTRIC LAMPS. J. Meszaros. 667. January 11th.

ELECTRICAL BLOCK SIGNALLING APPARATUS FOR RAILWAYS AND THE LIKE. F. W. Smith. 2,150. January 29th.

ELECTRODES FOR ELECTRIC FURNACES. M. Ruthenburg. 4,175. February 20th.

ELECTROMAGNETIC COUNTERS. M. S. Conner. 4,271. February 22nd.

APPARATUS FOR PLOTTING MAGNETIC LINES OF FORCE AND FOR LIKE PURPOSES. T. Parkes. 6,258. March 16th.

PROTECTIVE COVERINGS FOR SHIPS' PROPELLER SHAFTS AND OTHER MACHINE PARTS, SAID COVERING BEING ALSO ADAPTED TO SERVE FOR ANALOGOUS PURPOSES, SUCH AS THE LININGS OF CELLS FOR ELECTRIC ACCUMULATORS AND OF ROOMS FOR CONTAINING ELECTRIC ACCUMULATORS. H. D. Traun. 11,116. May 11th.

DYNAMOS OR ELECTRICAL MOTORS. J. H. Garty. 14,391. June 19th.

ROTORS OF DYNAMO-ELECTRIC MACHINES FOR REDUCING NOISE. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 19,012. August 18th.

DYNAMO-ELECTRIC MACHINES. B. G. Lamme. 19,392. August 23rd. (Date applied for under International Convention, October 7th, 1908.)

MEANS FOR COOLING THE ROTOR WINDINGS IN DYNAMO-ELECTRICAL MACHINERY. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 19,590. August 26th.